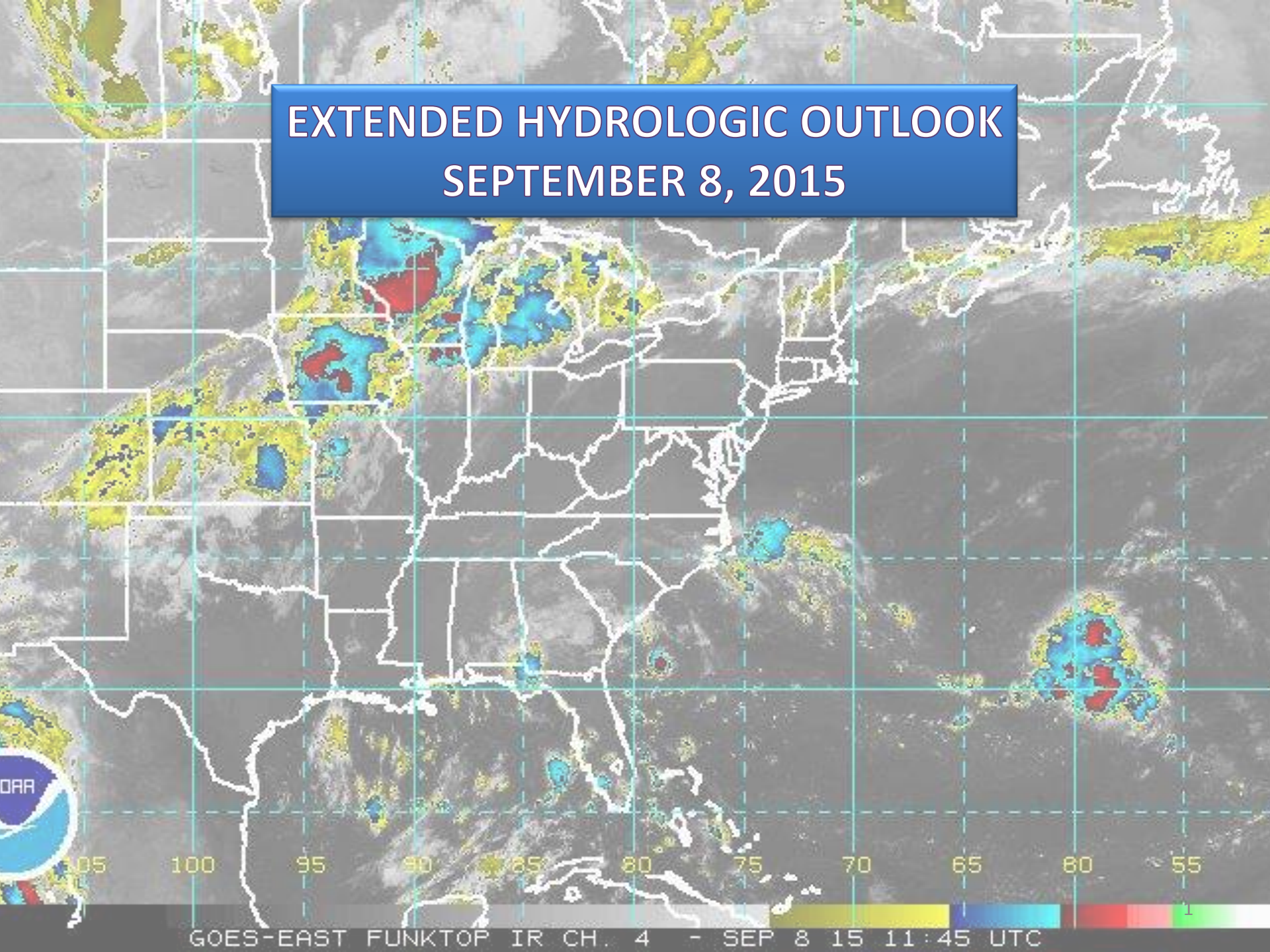


# EXTENDED HYDROLOGIC OUTLOOK SEPTEMBER 8, 2015



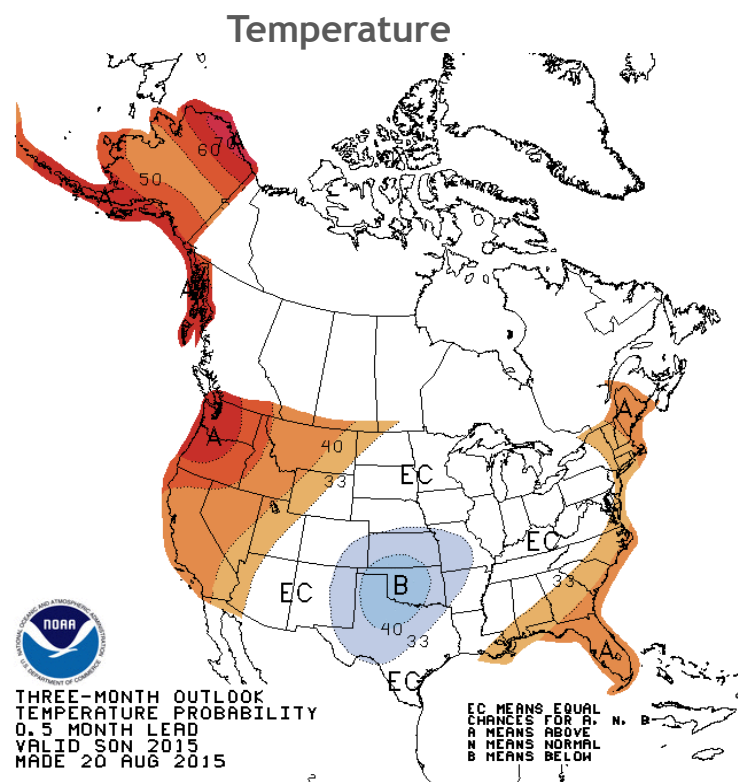
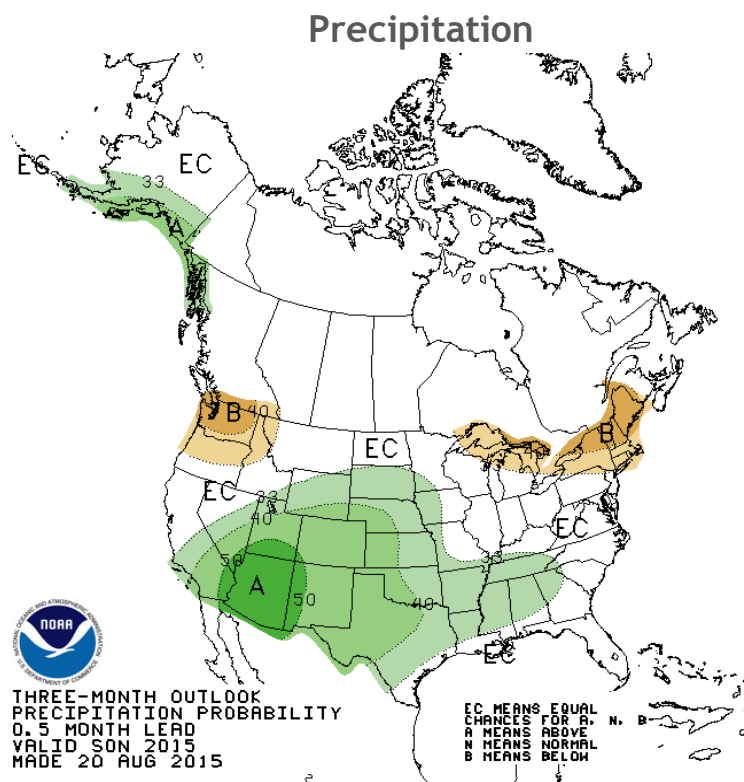
# Summary

- The Climate Prediction Center (CPC) is forecasting equal chances of above-normal, normal and below-normal rainfall for September through November.
- El Niño conditions continue to strengthen. A moderate to strong El Niño is likely to persist into early 2016. The latter half of the wet season will tend towards normal rainfall probabilities. There are increased chances of above normal rainfall for the 2015-2016 dry season.
- The wet season should tend to have less tropical activity that will affect Florida. NOAA CPC issued 90% likelihood of below normal hurricane activity due to stronger vertical wind shear, enhanced sinking motion, increased atmospheric stability.
- The Atlantic Multidecadal Oscillation (AMO) may be entering the cold (negative) phase, which creates the potential for drier conditions in south Florida. AMO cold (negative) also decreases tropical activity in the Atlantic.
- The current switch from the negative phase to a strong positive phase of the Pacific Decadal Oscillation increases the potential for above normal rainfall in the winter and a greater number of El Niño events for multi-year periods.

# U. S. Seasonal Outlooks

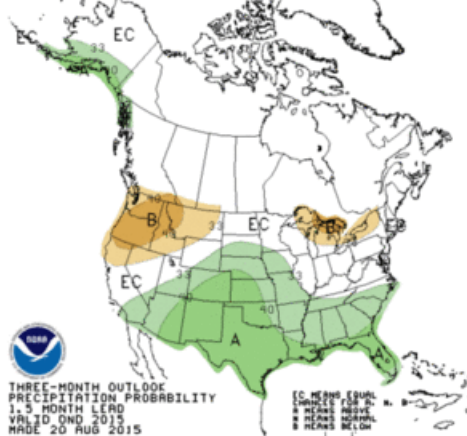
September - November 2015

The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.

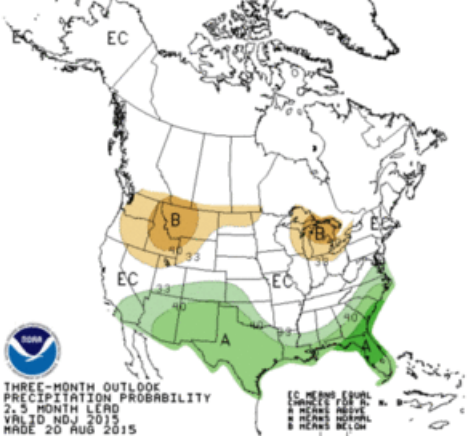




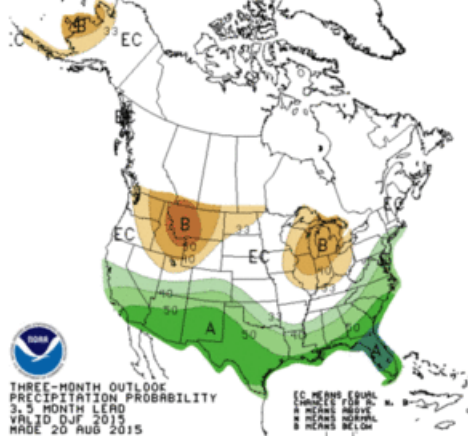
Oct-Nov-Dec 2015



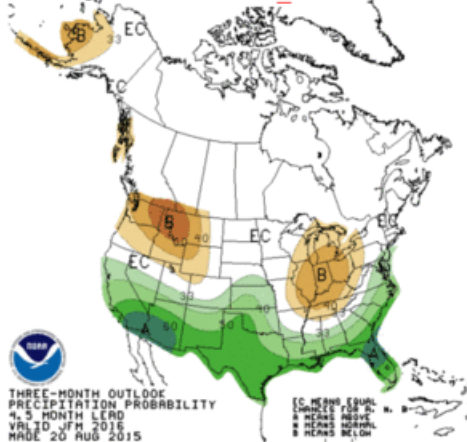
Nov-Dec-Jan 2015



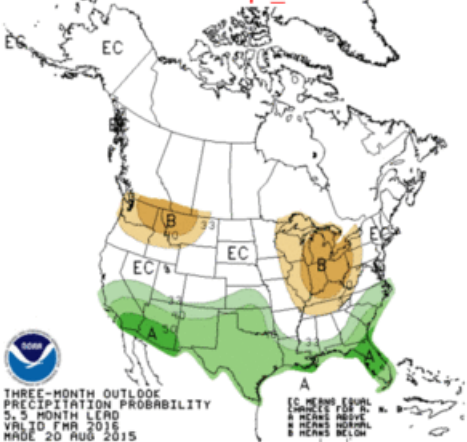
Dec-Jan-Feb 2015



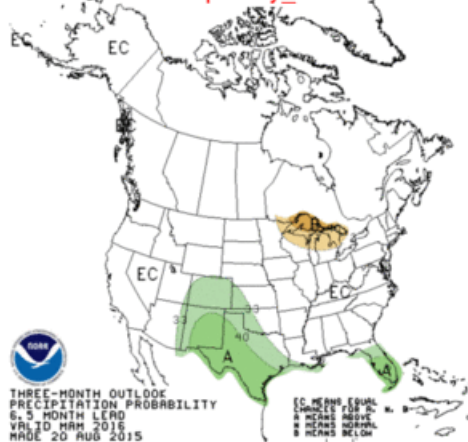
Jan-Feb-Mar 2016



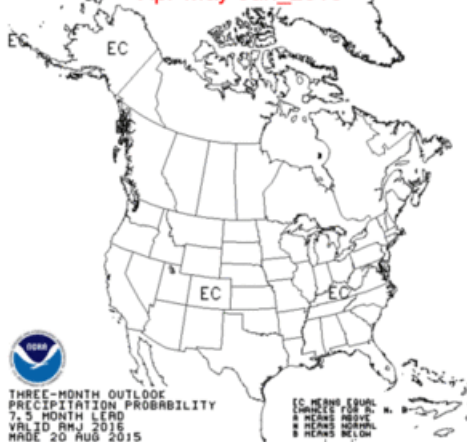
Feb-Mar-Apr 2016



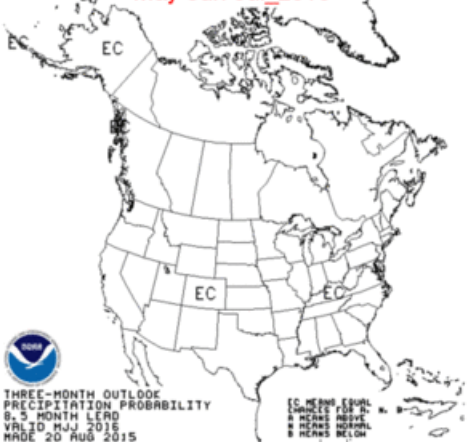
Mar-Apr-May 2016



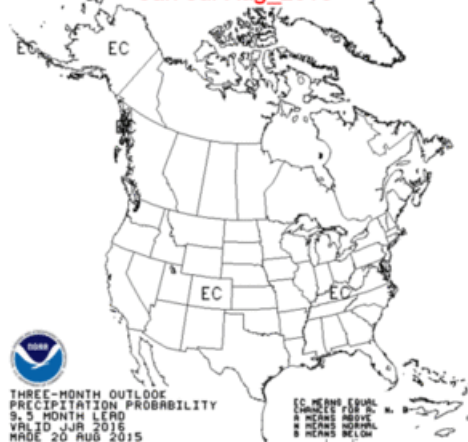
Apr-May-Jun 2016



May-Jun-Jul 2016



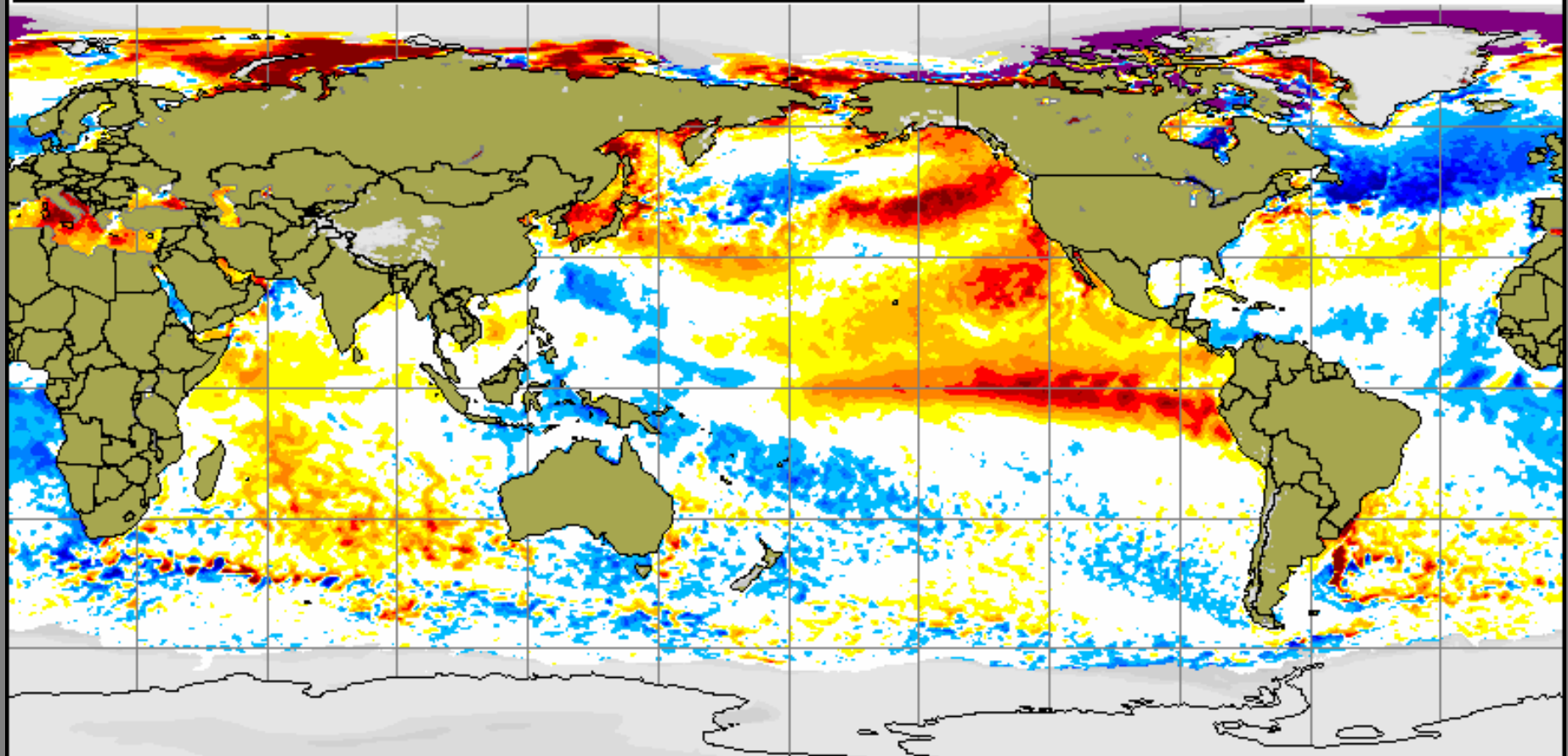
Jun-Jul-Aug 2016



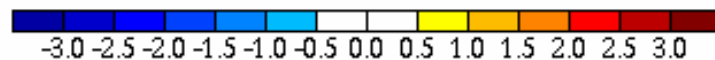
# Current Global Sea Surface Temperature Anomalies

Global sea surface anomaly and snow cover  
10 Aug 2015

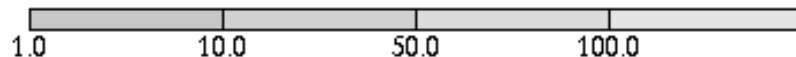
Anomalie de la température de la mer et épaisseur de la neige  
10 Août 2015



Sea surface temperature anomaly / Anomalie de la température de la mer (°C)



Snow depth / Épaisseur de la neige (cm)



Uncovered sea ice  
Glace marine à découvert

Climatologie 1995-2009 Climatologie

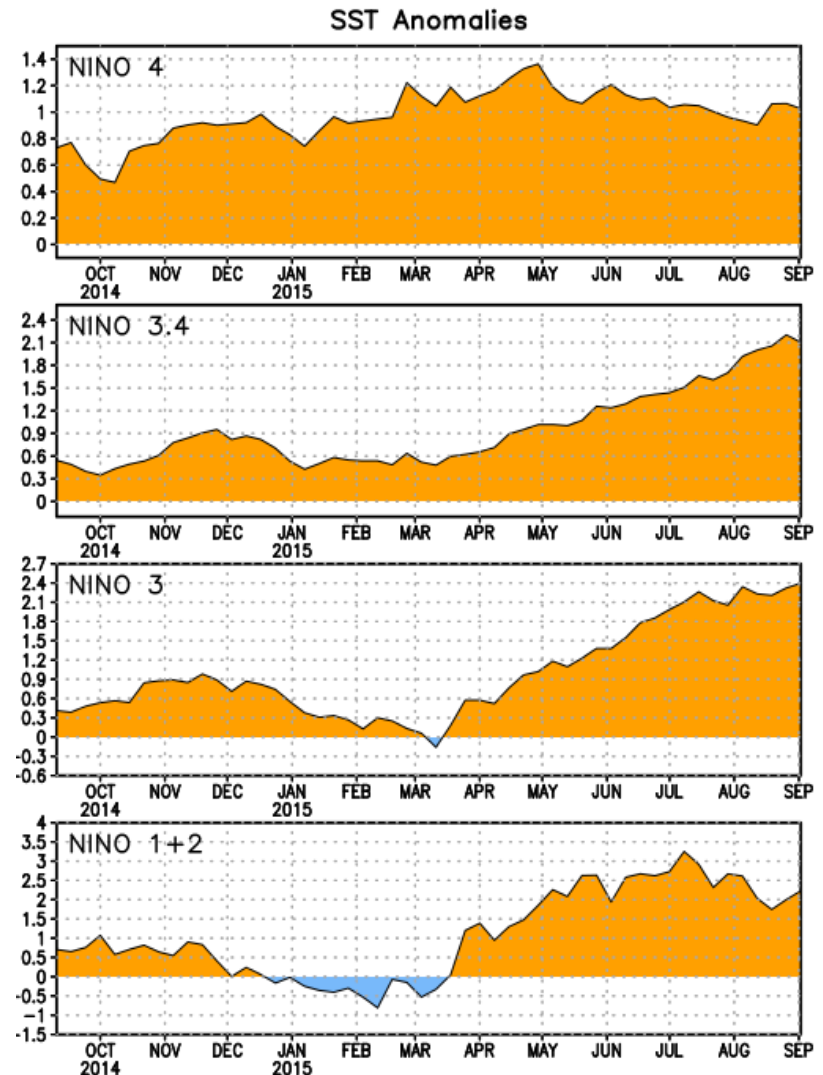
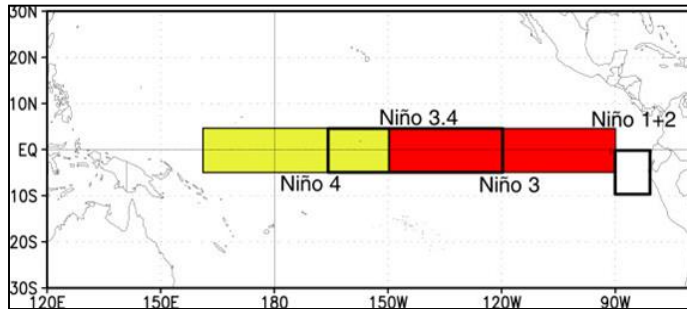


CMC Environnement Canada  
CMC Environnement Canada

# Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

Niño 4	1.0°C
Niño 3.4	2.1°C
Niño 3	2.4°C
Niño 1+2	2.2°C



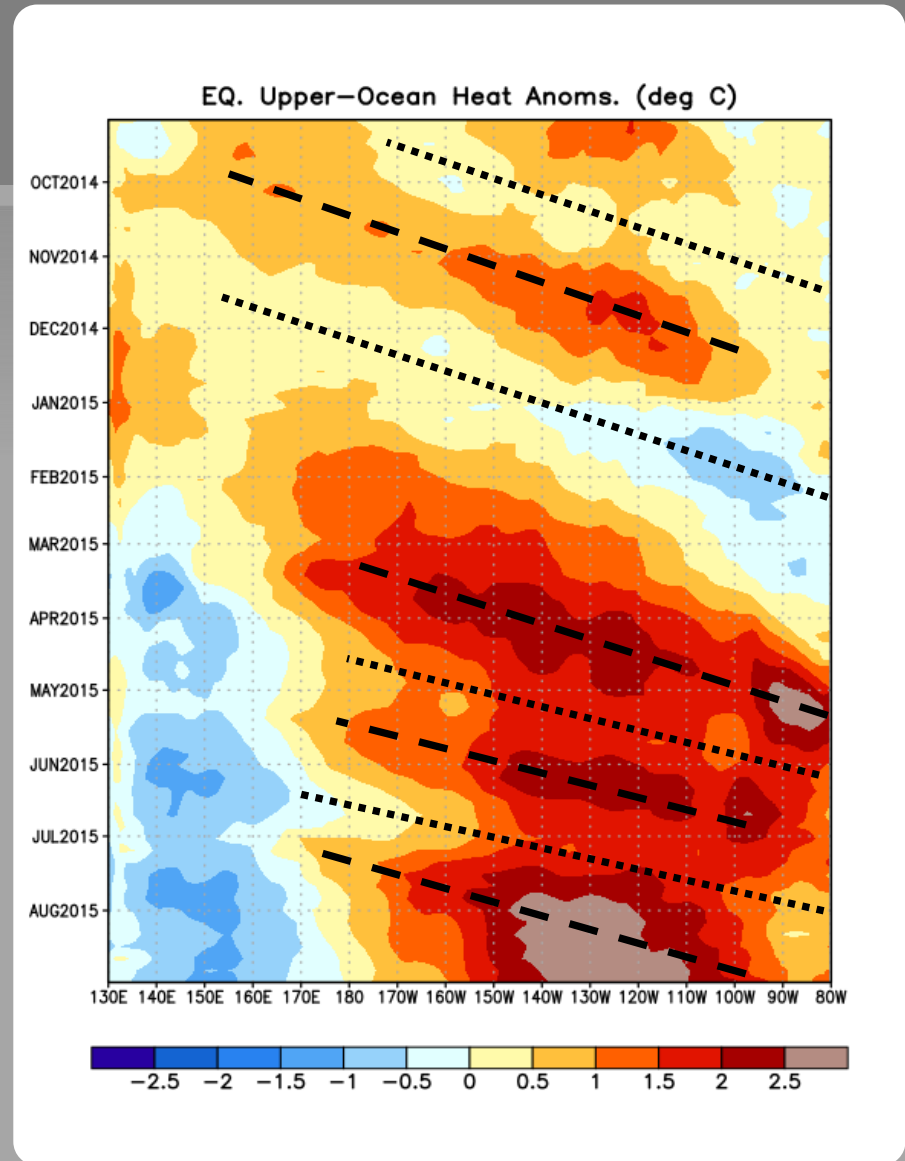
# Weekly Heat Content Evolution in the Equatorial Pacific

During November - January, the upwelling phase of a Kelvin wave shifted eastward. This was followed by the downwelling phase of a Kelvin wave in March-April.

From mid-May to late June, another Kelvin wave crossed the Pacific.

Since early July, the downwelling phase of a third Kelvin wave during 2015 is evident.

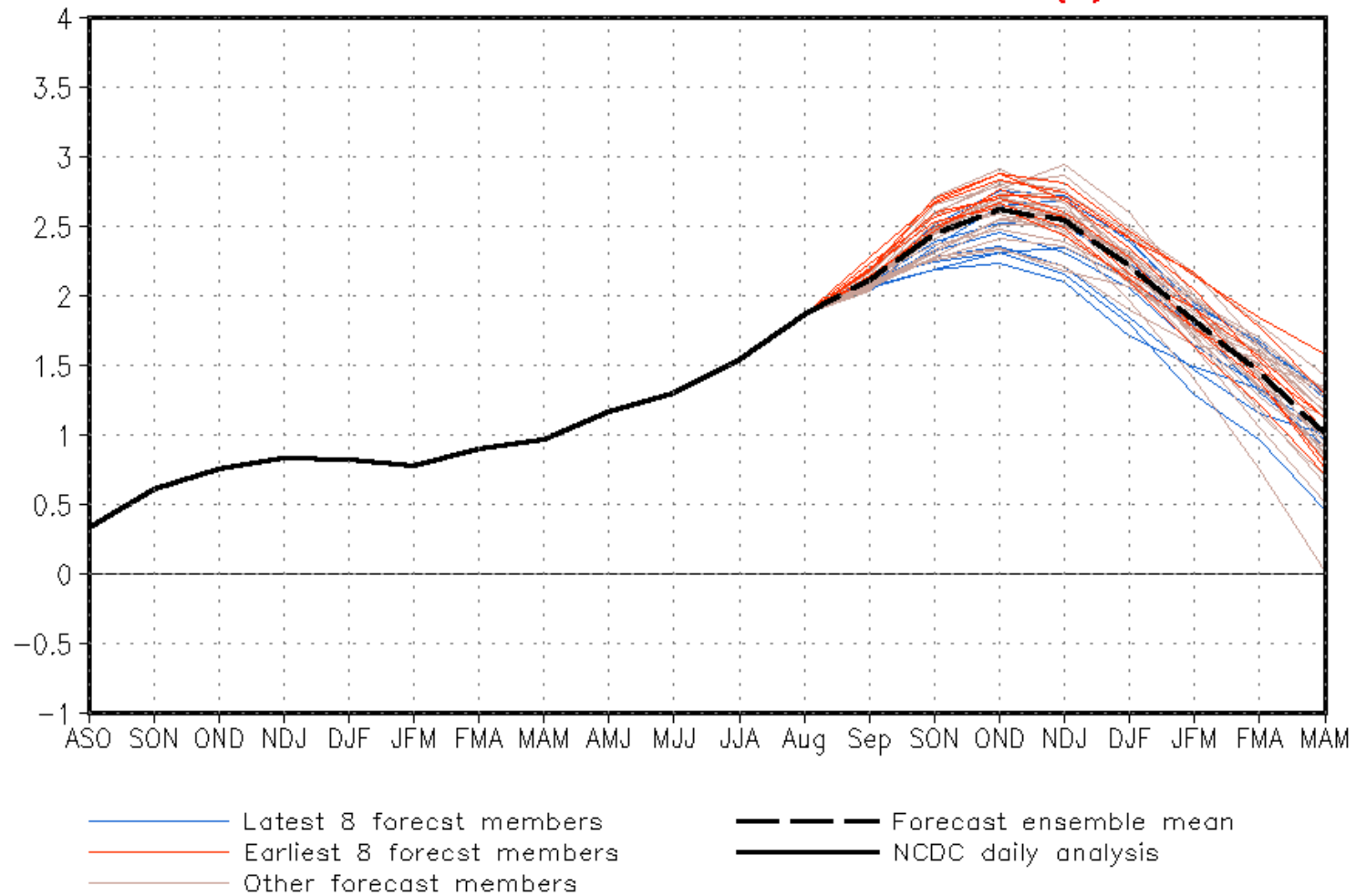
Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.







### CFSv2 forecast Nino3.4 SST anomalies (K)





# IRI/CPC Pacific Niño

## 3.4 SST Model Outlook

All models indicate Niño 3.4 SST anomalies will remain greater than or equal to  $+0.5^{\circ}\text{C}$  through JFM 2016.

All multi-model averages indicate that Niño 3.4 will be above  $+1.5^{\circ}\text{C}$  (a “strong” El Niño) during late 2015 into early 2016.

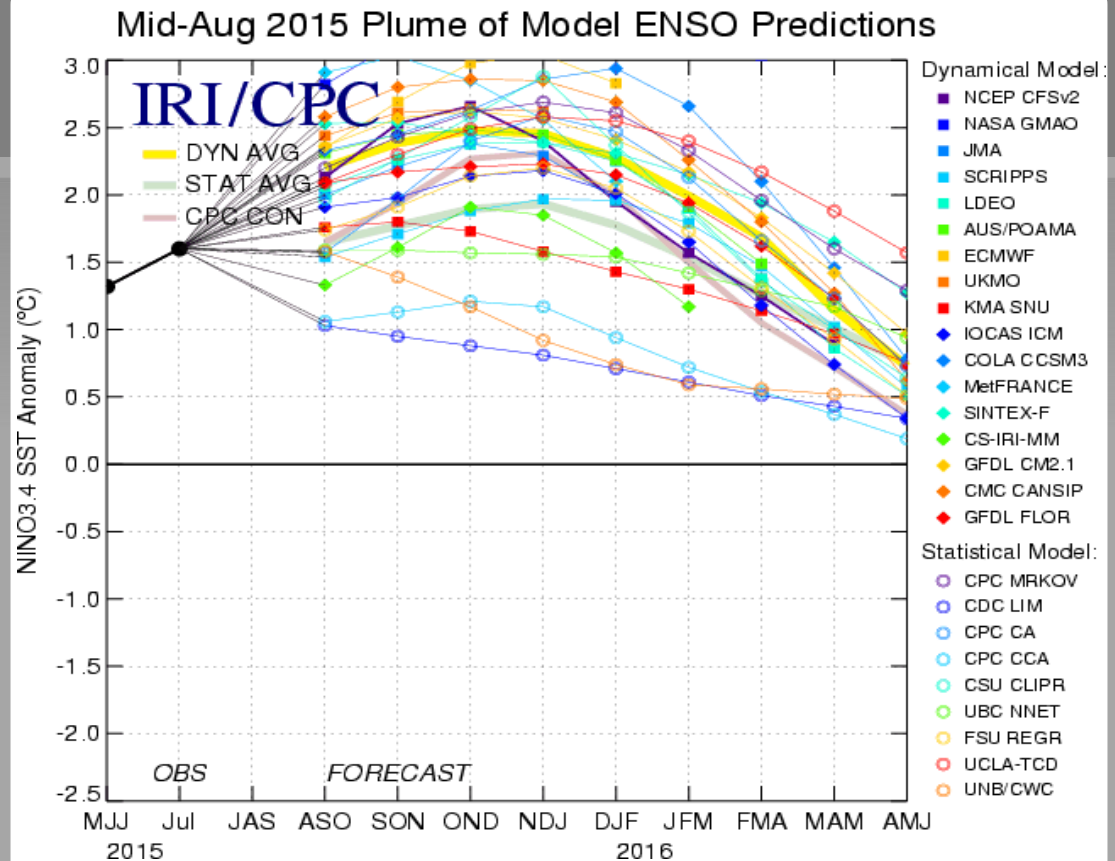
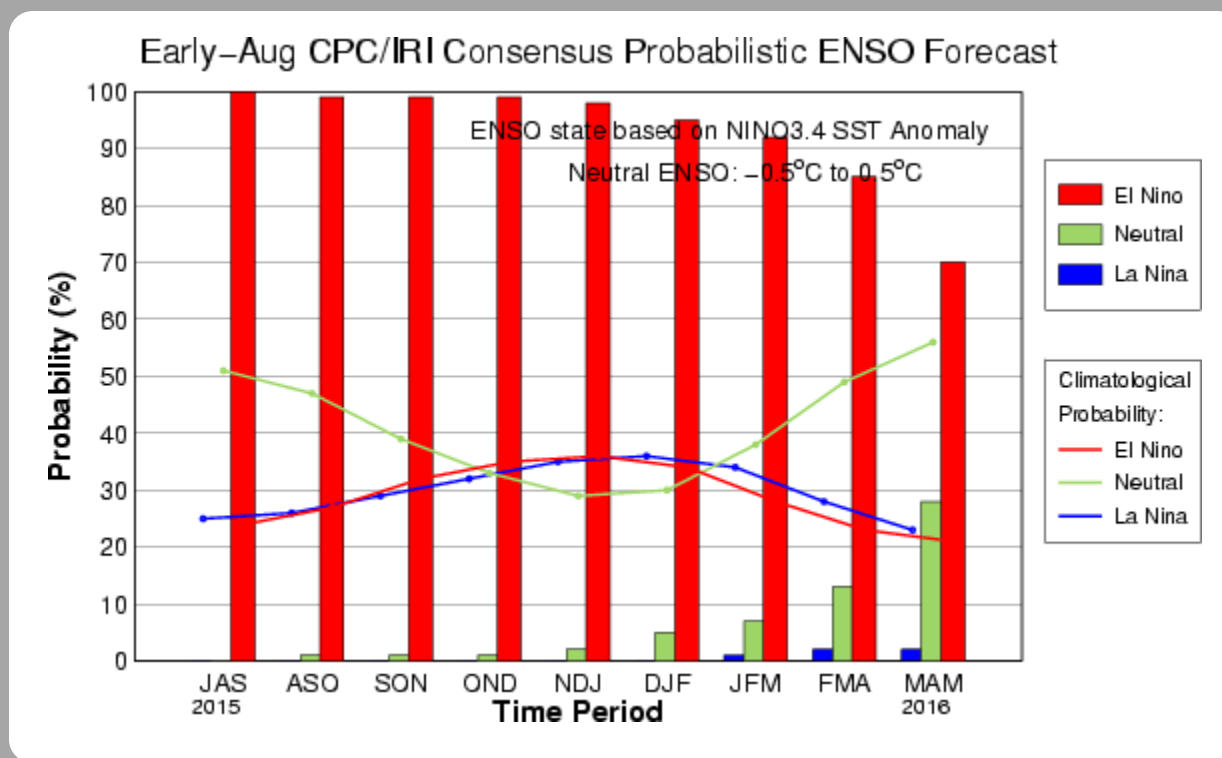


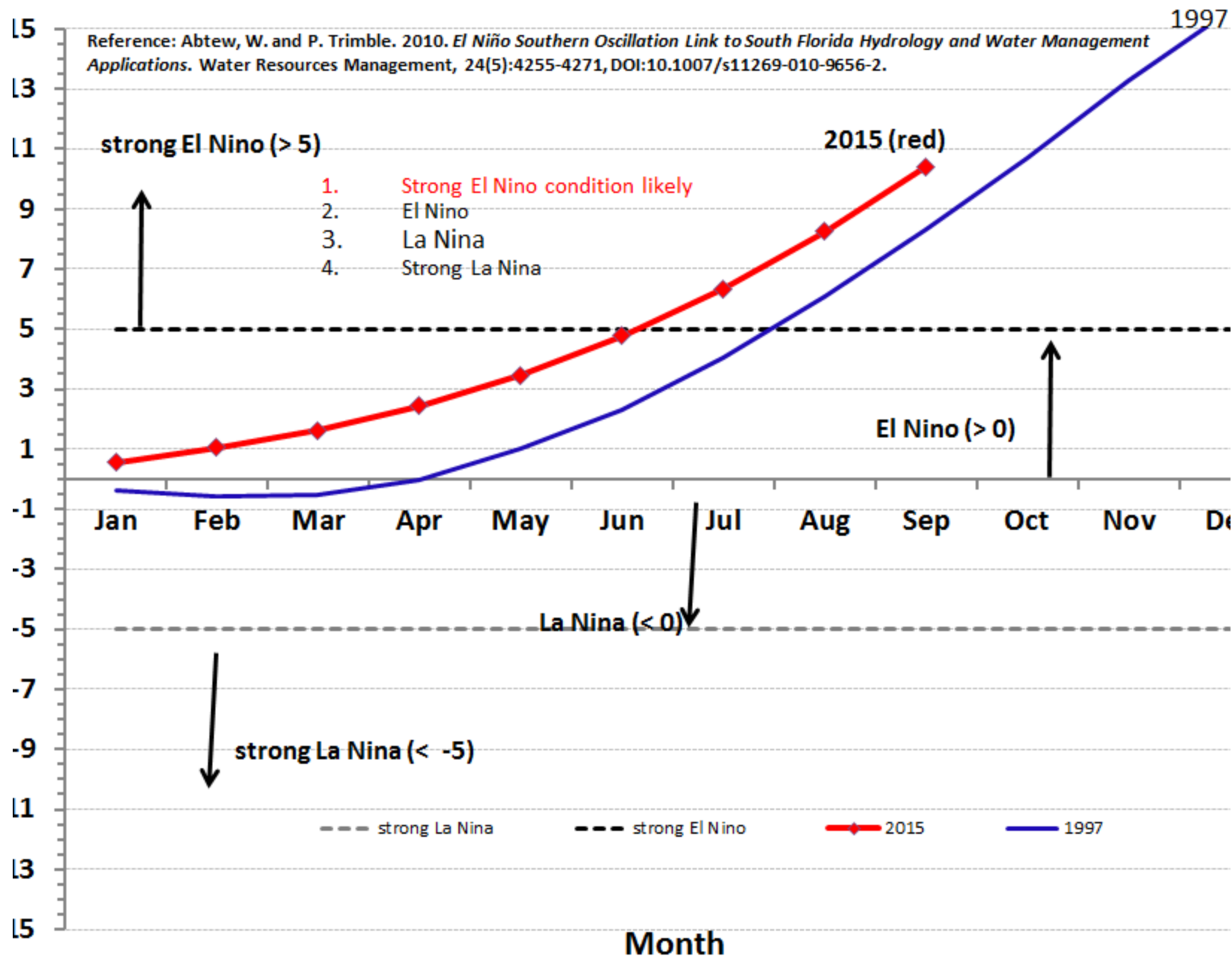
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 August 2015).

# CPC/IRI Probabilistic ENSO Outlook

Updated: 13 August 2015

The chance of El Niño is greater than 90% through Northern Hemisphere winter and is near 70% through spring (MAM) 2016.





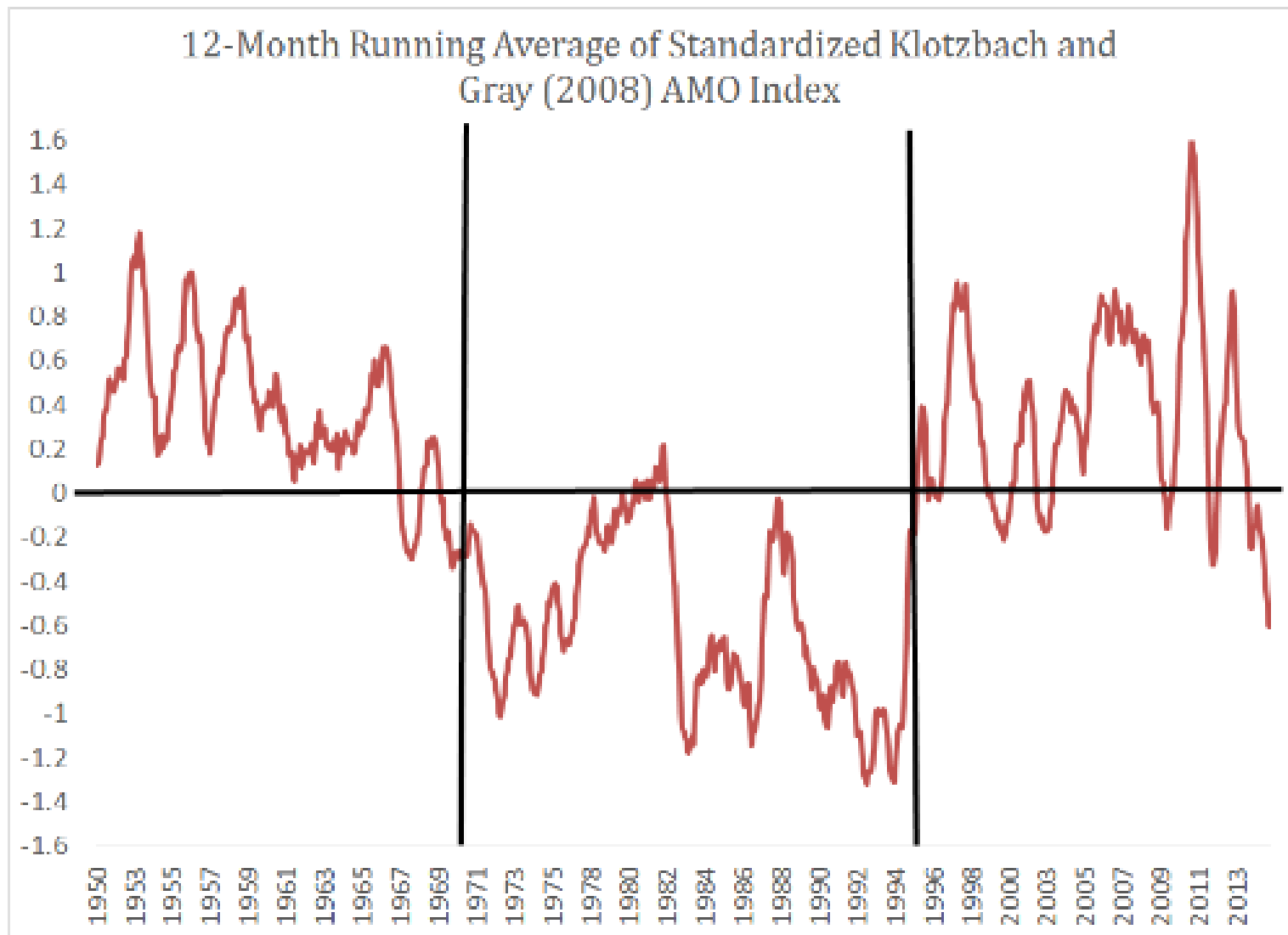
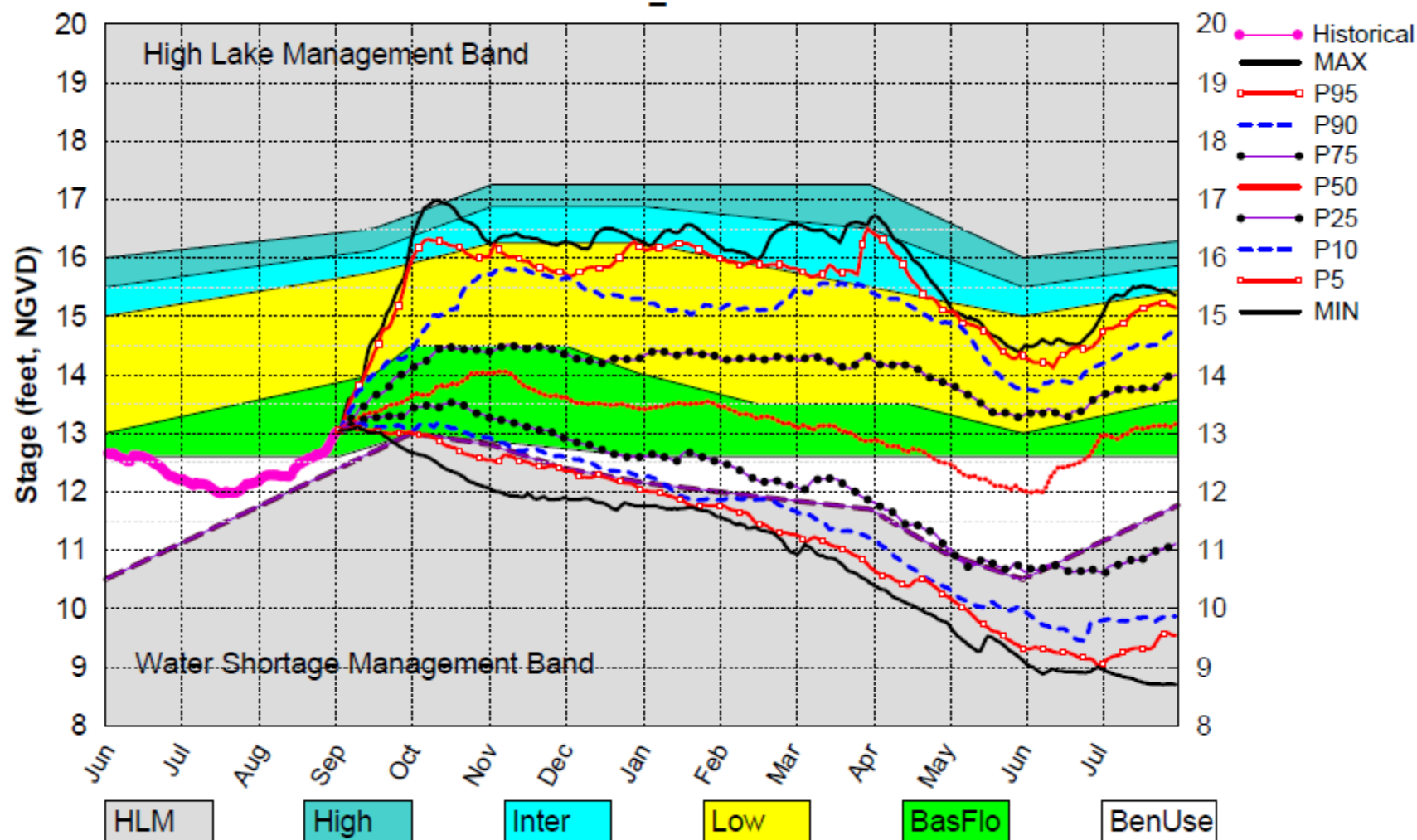


Figure 17: 12-month running average values of our standardized index of the AMO/THC. Current 12-month running average values are at their lowest since 1994.



# Lake Okeechobee SFWMM September 2015 Position Analysis

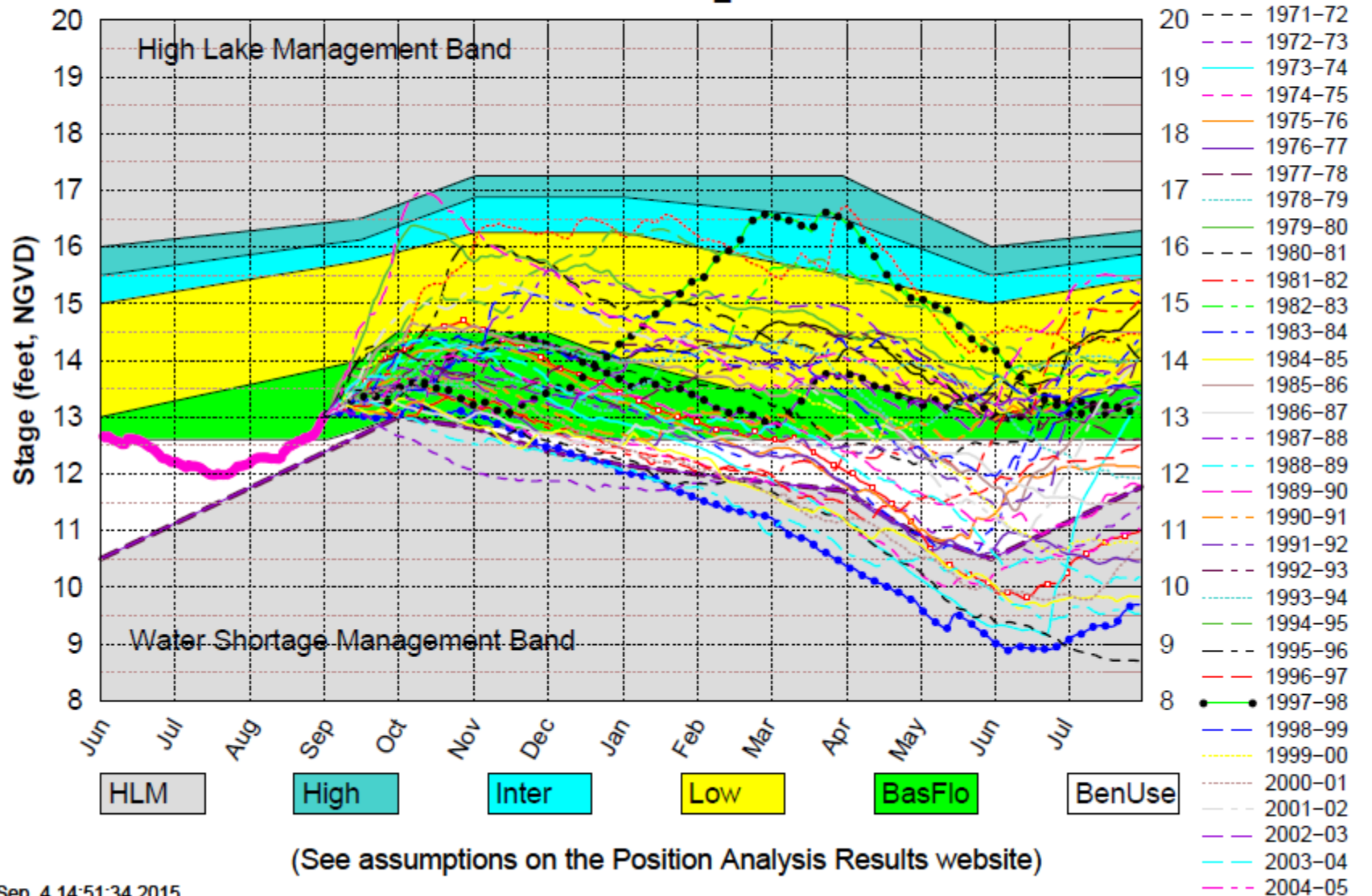
Percentiles PA\_SEP15DPA



(See assumptions on the Position Analysis Results website)

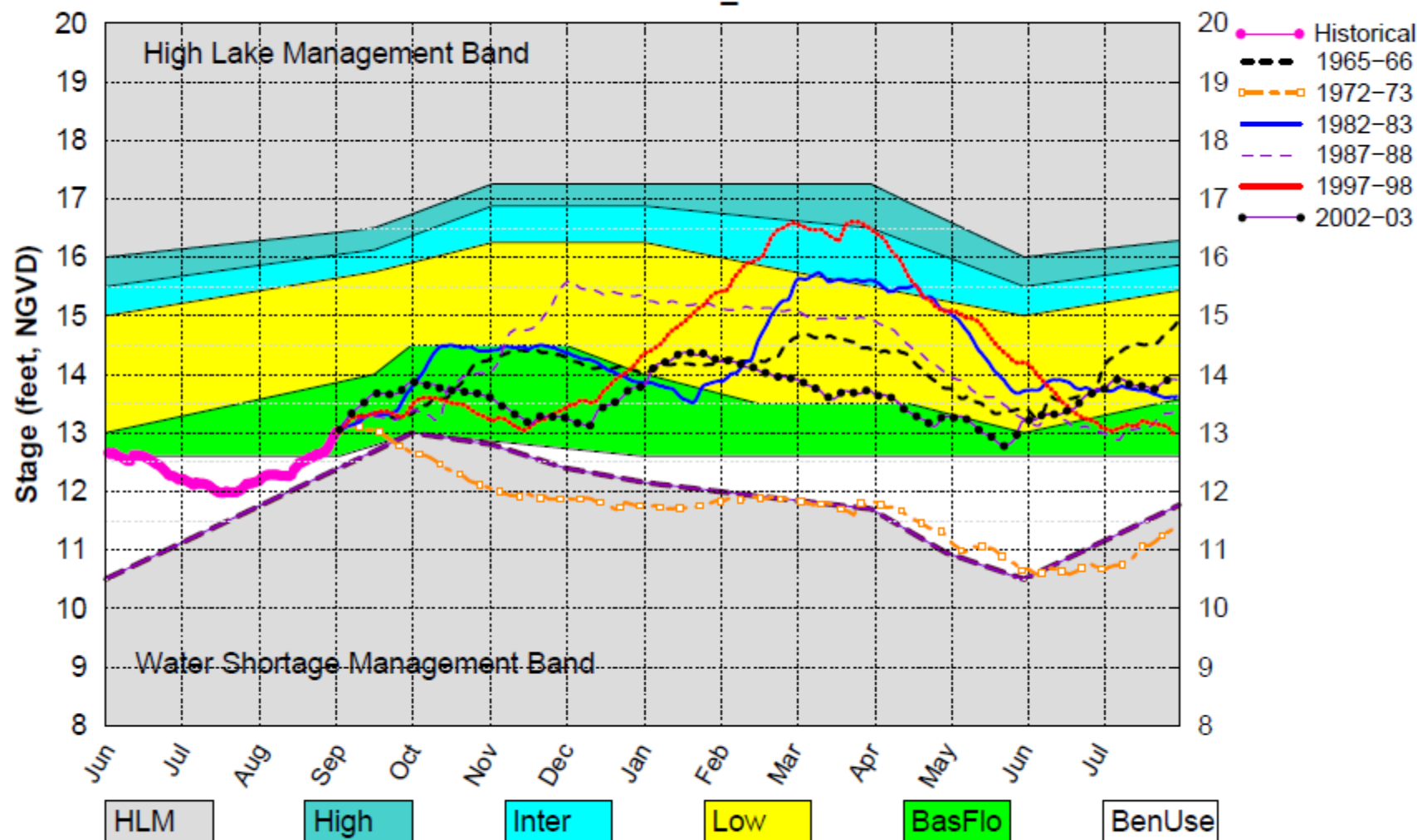
# Lake Okeechobee SFWMM September 2015 Position Analysis

All Simulated Years Plot PA\_SEP15DPA



# Lake Okeechobee SFWMM September 2015 Position Analysis

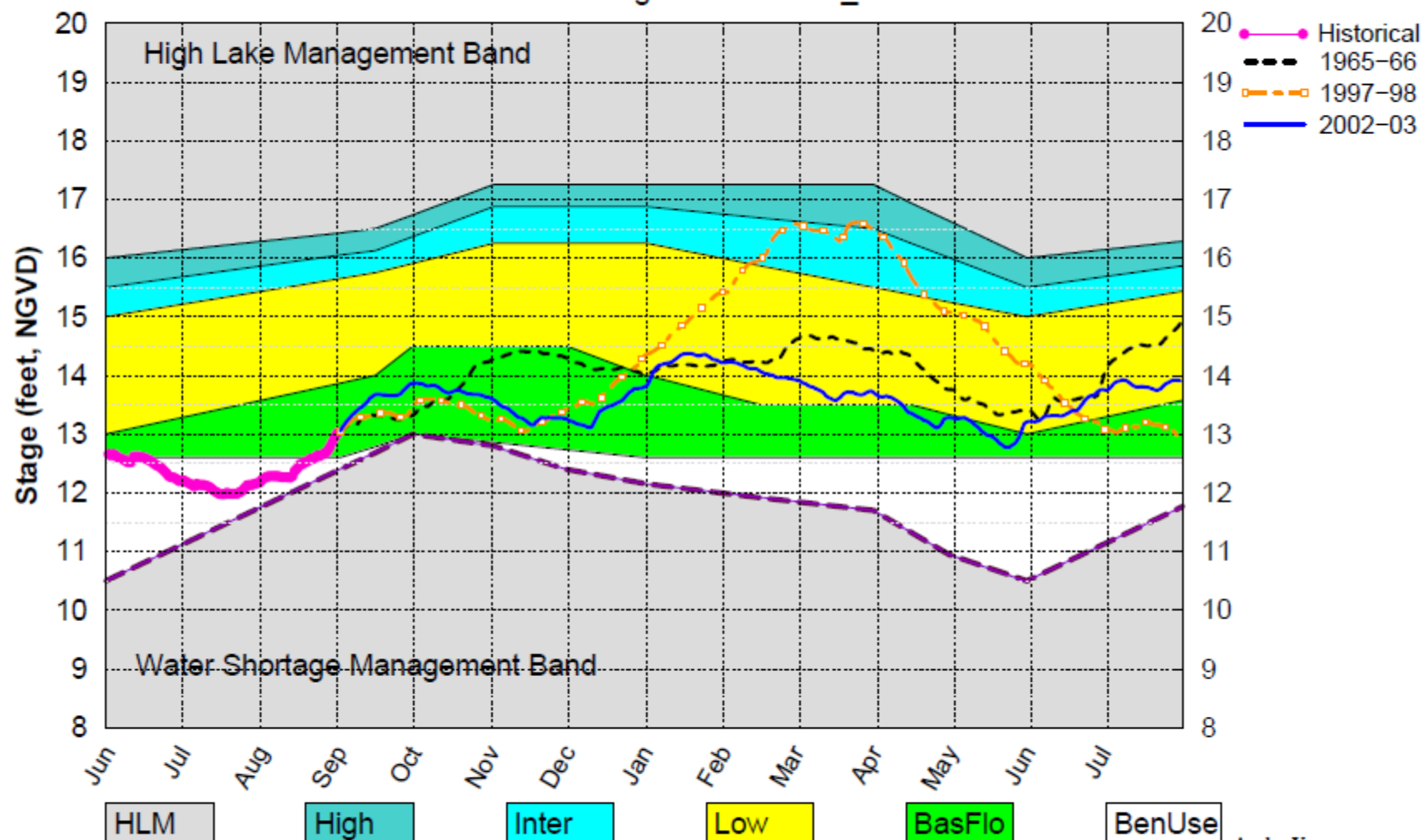
All El Nino Years Plot PA\_SEP15DPA



(See assumptions on the Position Analysis Results website)

# Lake Okeechobee SFWMM September 2015 Position Analysis

AMO Warm / El Nino Analog Years Plot PA\_SEP15DPA



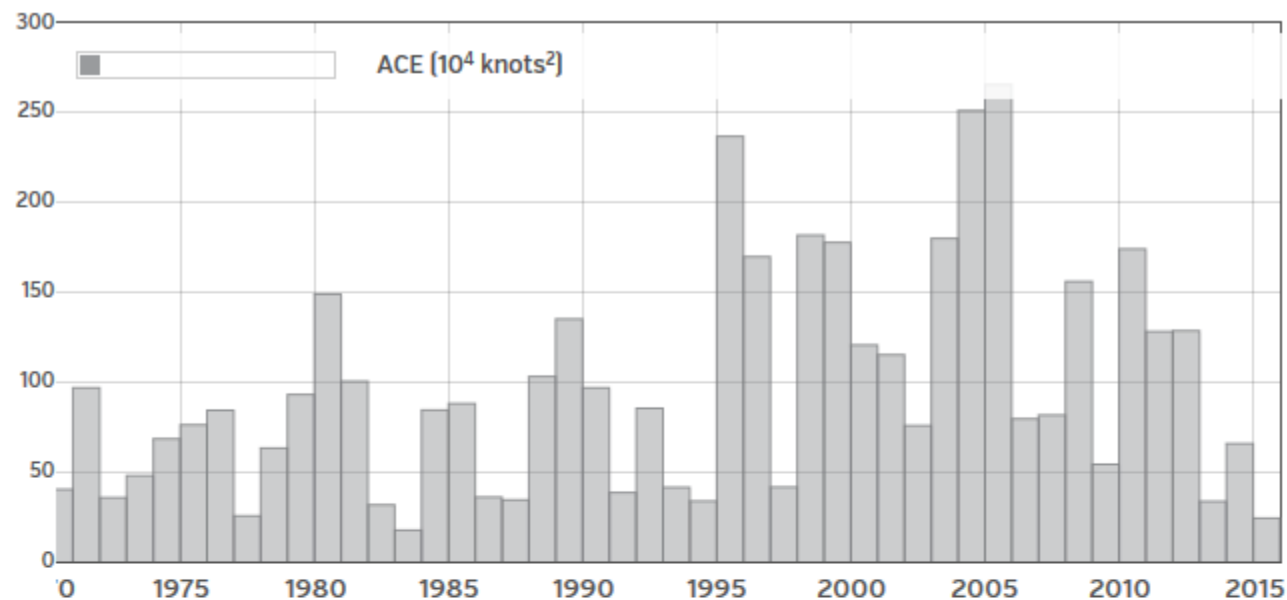
(See assumptions on the Position Analysis Results website)

Analog Years are years with similar climatological conditions to the current year.



# Tropical Season Outlook

Updated: September 08, 2015



Average year: 110

2015 year-to-date: 24

### Atlantic Tropical Cyclones of 2015

Tropical Cyclone Name	Start Date	Max Wind Speed (kt)	ACE ( $10^4$ kt <sup>2</sup> )
ANA	May 08, 2015	50	2.28
BILL	June 16, 2015	50	1.0275
CLAUDETTE	July 13, 2015	45	1.13
DANNY	August 18, 2015	100	9.1975
ERIKA	August 25, 2015	45	2.9425
FRED	August 30, 2015	75	5.65
GRACE	September 05, 2015	45	1.86

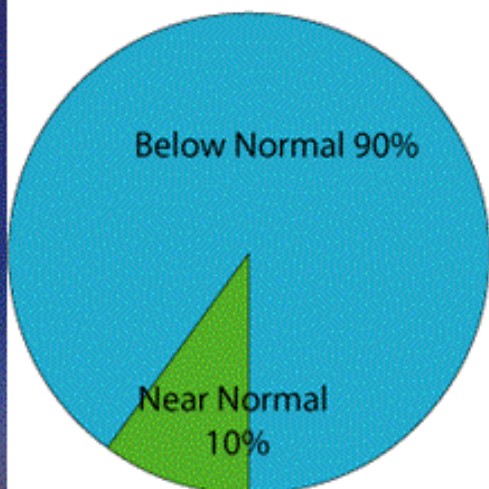
Source: Weather Underground



## NOAA's Updated 2015 Atlantic Hurricane Season Outlook

### NOAA's Updated 2015 Atlantic Hurricane Season Outlook 90% Chance of Below-Normal Season

#### Probability of Season Type



#### Predicted Activity

*70% Probability For Each Range*

<b>Named Storms</b>	<b>6-10</b>
<b>Hurricanes</b>	<b>1-4</b>
<b>Major Hurricanes</b>	<b>0-1</b>

#### Season Averages (1981-2010)

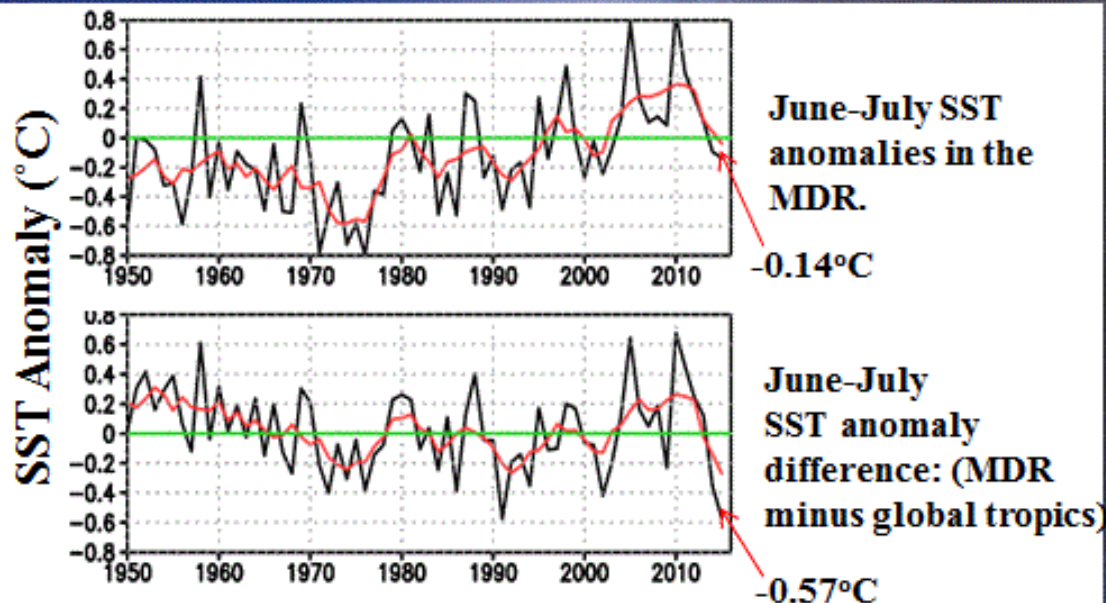
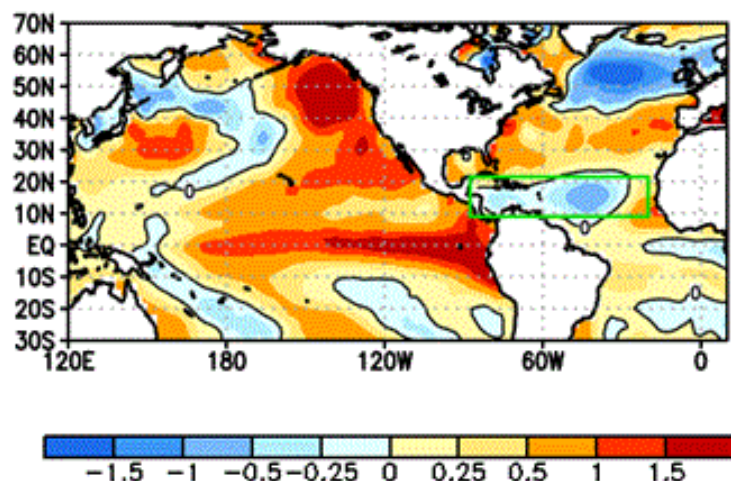
<b>12</b>
<b>6</b>
<b>3</b>





## June-July 2015: Atlantic SST Anomalies

### SST Anomalies ( $^{\circ}\text{C}$ )



**Caption:** (Left) June-July 2015 SST anomalies ( $^{\circ}\text{C}$ ) with green box denoting the MDR. (Right) June-July area-averaged SST anomalies since 1950: (Top) in the MDR, and (Bottom) difference between MDR and the global tropics (20 $^{\circ}\text{N}$ -20 $^{\circ}\text{S}$ ). Anomalies are departures from the 1981-2010 ERSST.V3b monthly means.

Tropical Atlantic SSTs were below average during June-July 2015. Area-averaged SST anomalies in the MDR were -0.17 $^{\circ}\text{C}$  during this period, which is much cooler (0.57 $^{\circ}\text{C}$  cooler) than the remainder of the global tropics.





# ENSO Impacts on U.S. regional Hurricane Activity

1410

JOURNAL OF CLIMATE

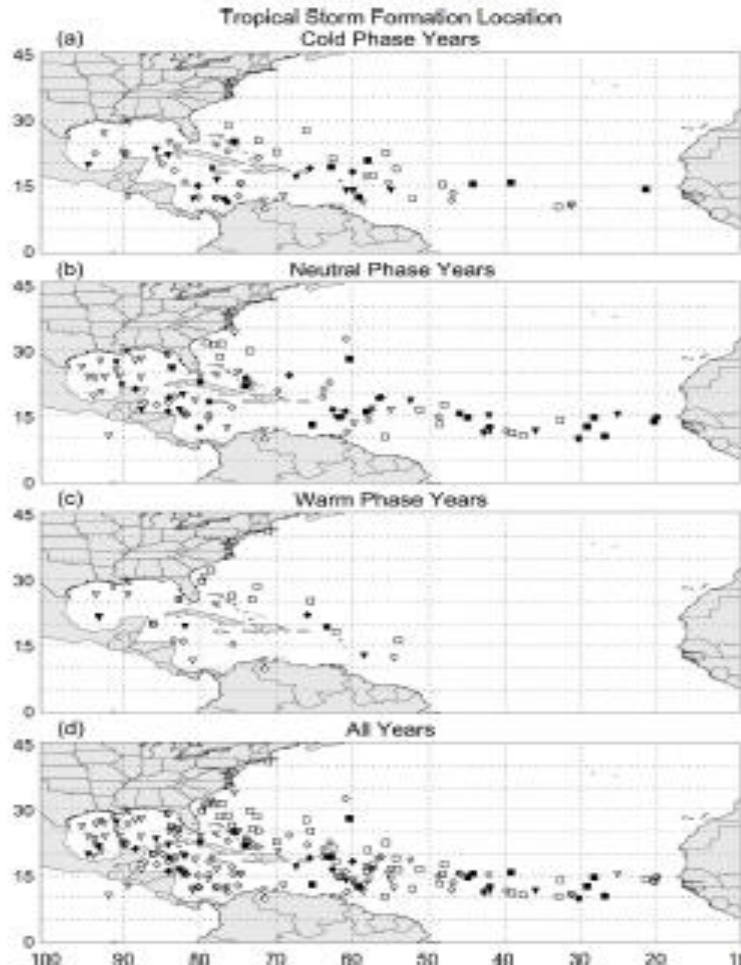


FIG. 5. Location at which hurricanes making landfall in the United States are first designated as a tropical storm (or stronger) within the HURDAT for ENSO (a) cold, (b) neutral, and (c) warm phases and (d) all years combined. Landfall location is separated into East Coast (square), Florida (diamond), and Gulf Coast (inverted triangle). Open symbols are hurricanes that made landfall as a category-1 or -2 storm, and closed symbols are hurricanes that made landfall as a category-3, -4, or -5 storm. Note that storms may move across land as a tropical storm and make landfall in a different section as a hurricane.

## Journal of Climate

### ENSO's Impact on Regional U.S. Hurricane Activity

SHAWN R. SMITH, JUSTIN BROLLEY, JAMES J. O'BRIEN, AND CARISSA A. TARTAGLIONE

*Center for Ocean-Atmospheric Prediction Studies, The Florida State University, Tallahassee, Florida*

(Manuscript received 5 December 2005, in final form 19 June 2006)

#### ABSTRACT

Regional variations in North Atlantic hurricane landfall frequency along the U.S. coastline are examined in relation to the phase of El Niño–Southern Oscillation (ENSO). ENSO warm (cold) phases are known to reduce (increase) hurricane activity in the North Atlantic basin as a whole. Using best-track data from the U.S. National Hurricane Center, regional analysis reveals that ENSO cold-phase landfall frequencies are only slightly larger than neutral-phase landfall frequencies along the Florida and Gulf coasts. However, for the East Coast, from Georgia to Maine, a significant decrease in landfall frequency occurs during the neutral ENSO phase as compared to the cold phase. Along the East Coast, two or more major (category 3 or above) hurricanes never made landfall in the observational record (1900–2004) during a single hurricane season classified as an ENSO neutral or warm phase.

## Total Number of Hurricanes El Niño is listed here as “Warm”

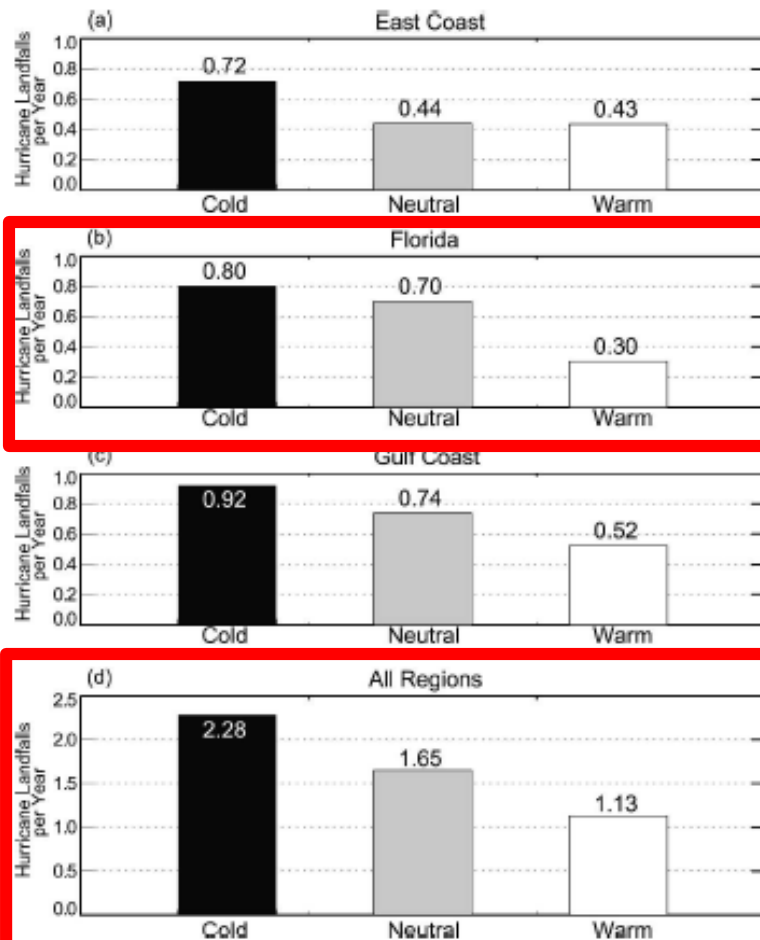


FIG. 2. Average number of hurricane landfalls per year (a) on the East Coast (except Florida), (b) in Florida, (c) along the Gulf Coast (except Florida), and (d) along the entire U.S. coastline from 1900 to 2004 during years classified as cold, neutral, or warm ENSO phases. As an example of how to interpret these averages, approximately one (0.92) landfall occurs per ENSO cold phase vs one landfall for every two ENSO warm phases (0.52) along the Gulf Coast.

## Total Number of Major Hurricanes El Niño is listed here as “Warm”

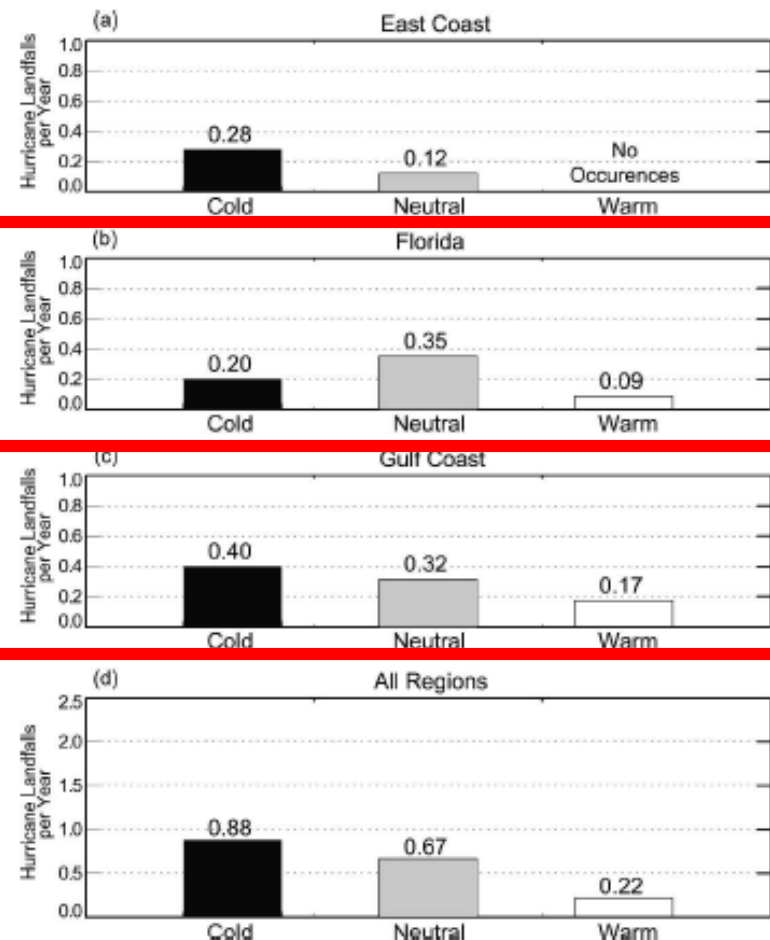
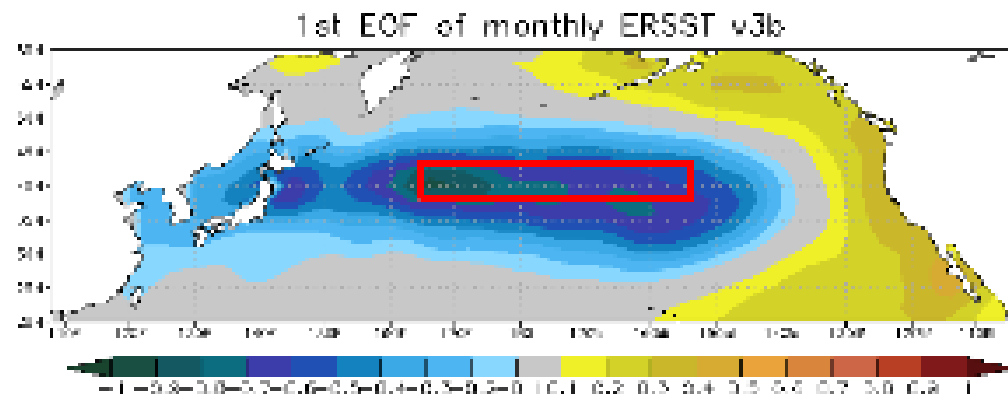
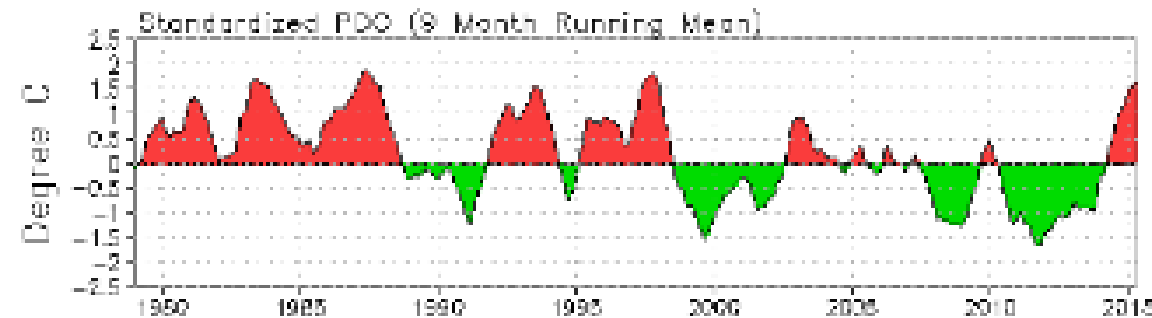
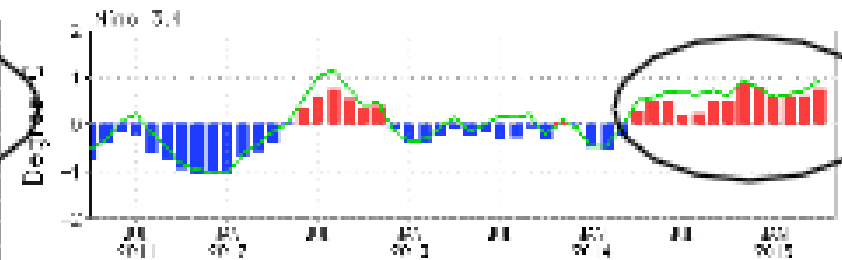
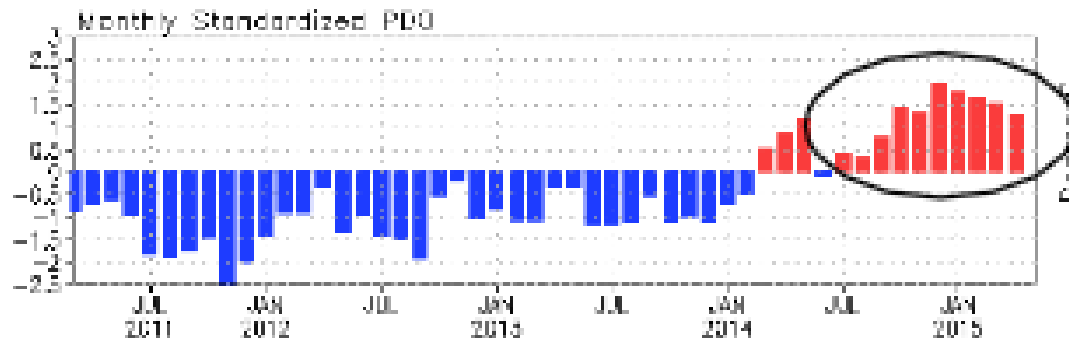


FIG. 3. Average number of major (category 3, 4, or 5) hurricane landfalls per year (a) on the East Coast (except Florida), (b) in Florida, (c) along the Gulf Coast (except Florida), and (d) along the entire U.S. coastline from 1900 to 2004 during years classified as cold, neutral, or warm ENSO phases. Within the 1900–2004 period, there were no occurrences of major hurricane landfalls along the East Coast during ENSO warm phases.

# Pacific Decadal Oscillation



- The positive phase of PDO index has persisted 10 months since Jul 2014 with PDO index = 1.3 in Apr 2015.

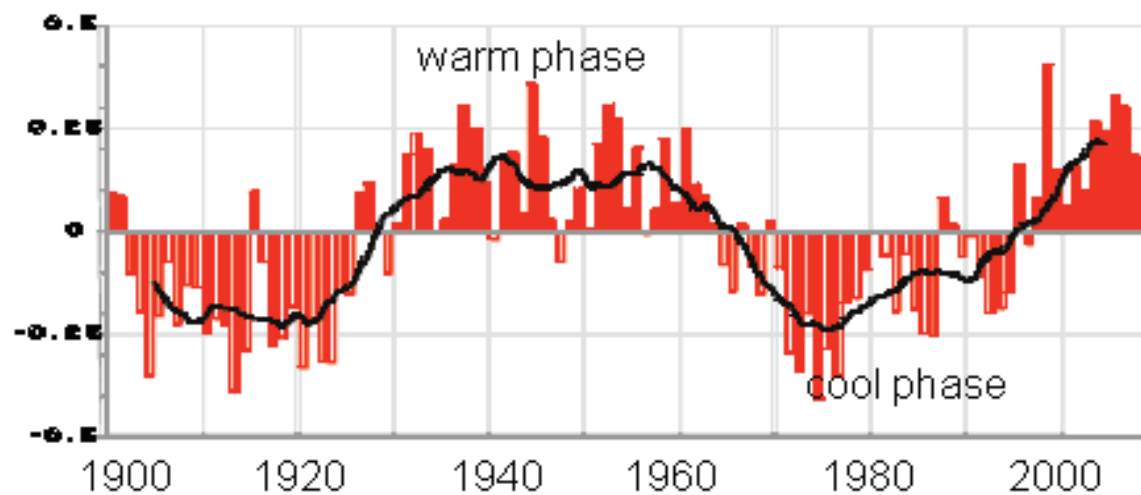
- Statistically, ENSO leads PDO by 3-4 months, may through atmospheric bridge.

- Pacific Decadal Oscillation is defined as the 1<sup>st</sup> EOF of monthly ERSST v3b in the North Pacific for the period 1900-1993. PDO index is the standardized projection of the monthly SST anomalies onto the 1st EOF pattern.

- The PDO index differs slightly from that of JISAO, which uses a blend of UKMET and OIv1 and OIv2 SST.

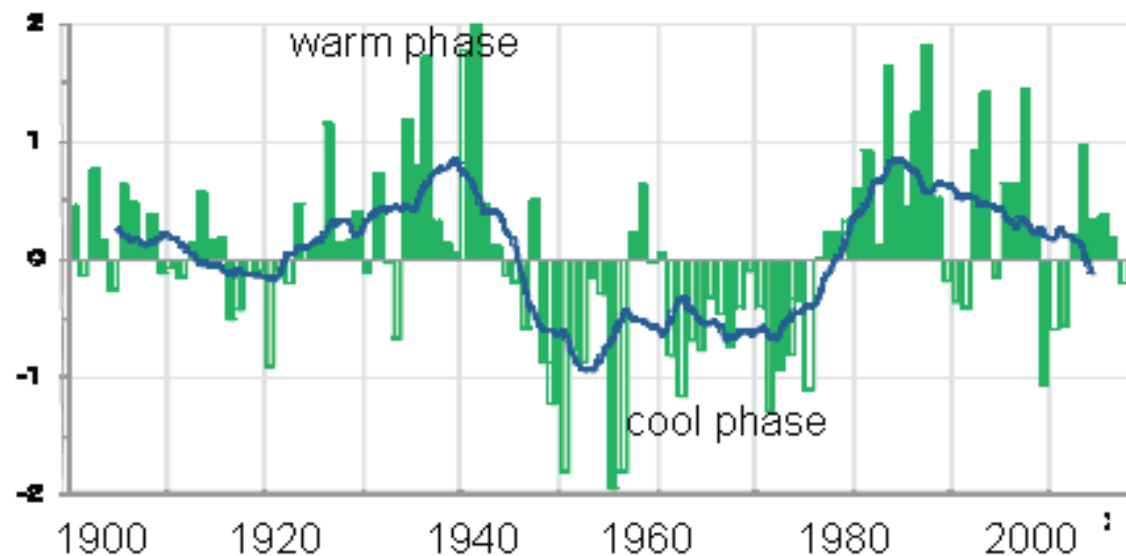


## Time series of multidecadal climate regimes



**Atlantic  
Multidecadal  
Oscillation (AMO)**

In warm phase  
since 1995



**Pacific Decadal  
Oscillation (PDO)**

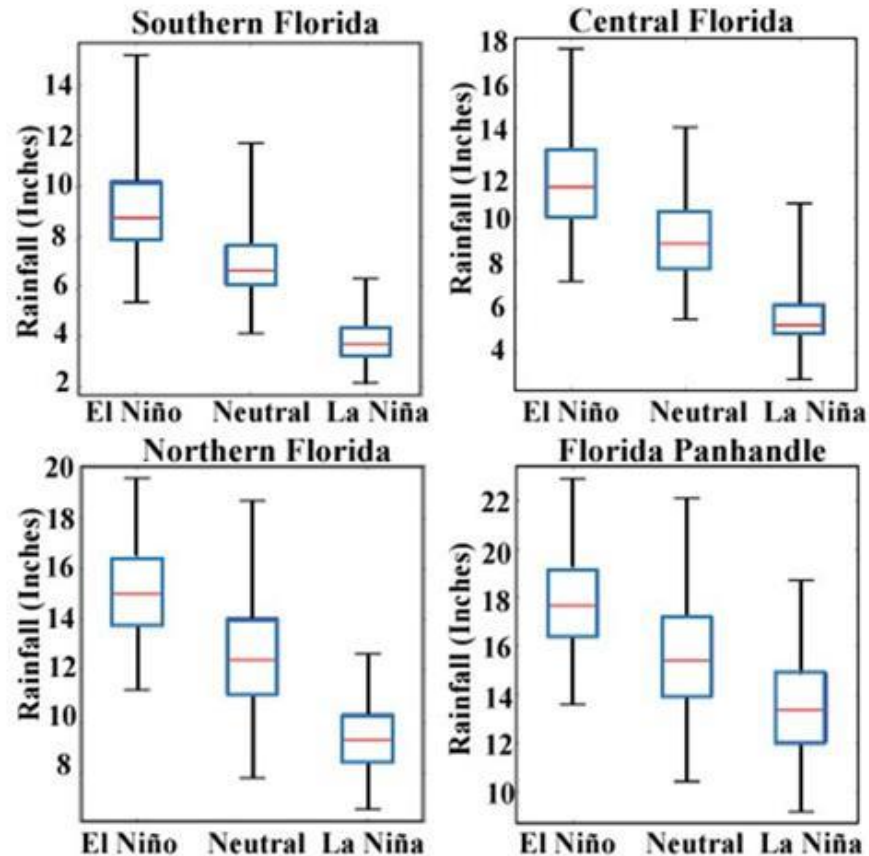
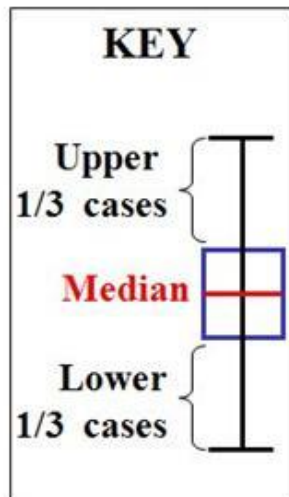
Just entering  
cool phase



Figure Courtesy: M. Jelinek



## Florida Winter Rainfall (Inches)



Throughout Florida, El Niño, Neutral, and La Niña wintertime rainfall differ dramatically

# Atlantic Multidecadal Warm and Cold Phases

## JOURNAL OF CLIMATE

1 AUGUST 2008

NOTES AND CORRESPONDENCE

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### NOTES AND CORRESPONDENCE

#### Multidecadal Variability in North Atlantic Tropical Cyclone Activity

PHILIP J. KLOTZBACH AND WILLIAM M. GRAY

Department of Atmospheric Science, Colorado State University, Fort Collins, Colorado

(Manuscript received 24 July 2007, in final form 14 January 2008)

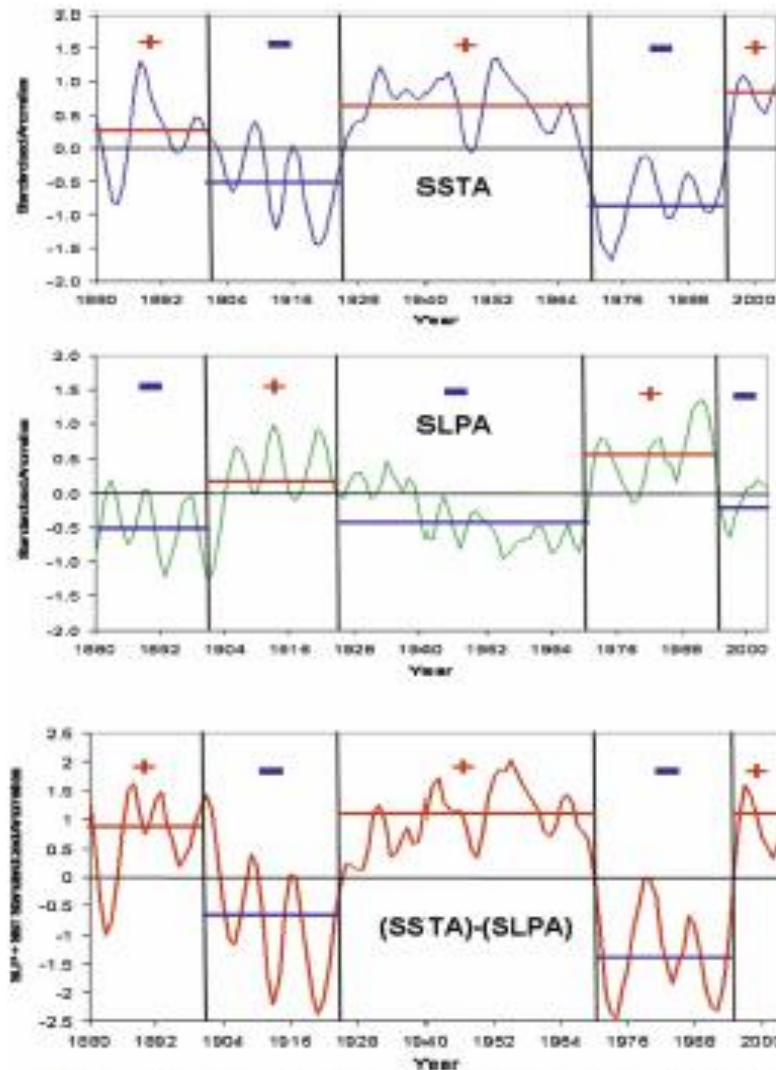


FIG. 1. Standardized values of (top) North Atlantic SSTA for the area from  $50^{\circ}$ – $60^{\circ}$ N and from  $50^{\circ}$ – $10^{\circ}$ W, (middle) North Atlantic SLPA for the area from  $0^{\circ}$ – $50^{\circ}$ N and from  $70^{\circ}$ – $10^{\circ}$ W, and (bottom) the combination of these two parameters ( $SSTA - SLPA$ ) taken to be the strength of the AMO from 1880 to 2004. Horizontal lines indicate average values for the multidecadal period, while (+) and (–) symbols indicate that positive or negative values of the particular index predominated during that period. A 1–2–3–2–1 filter has been applied to the data.

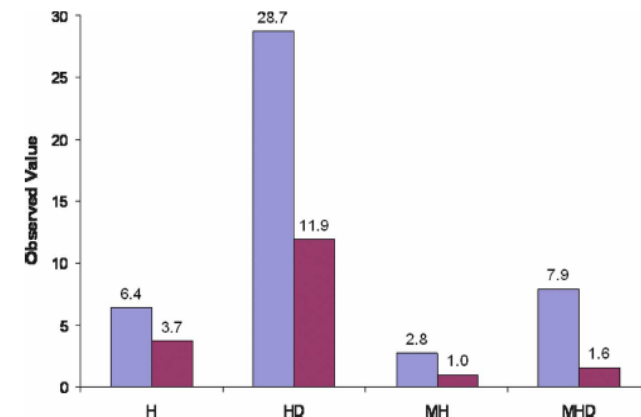
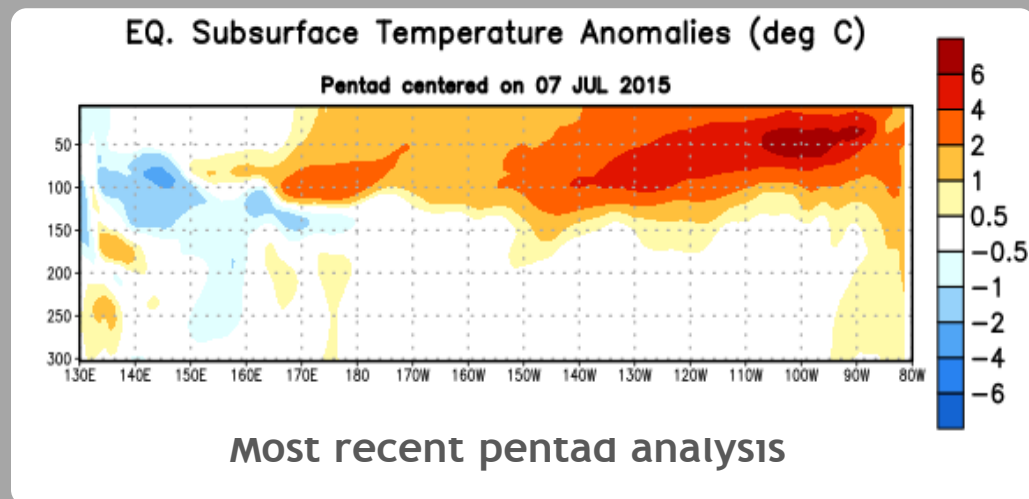


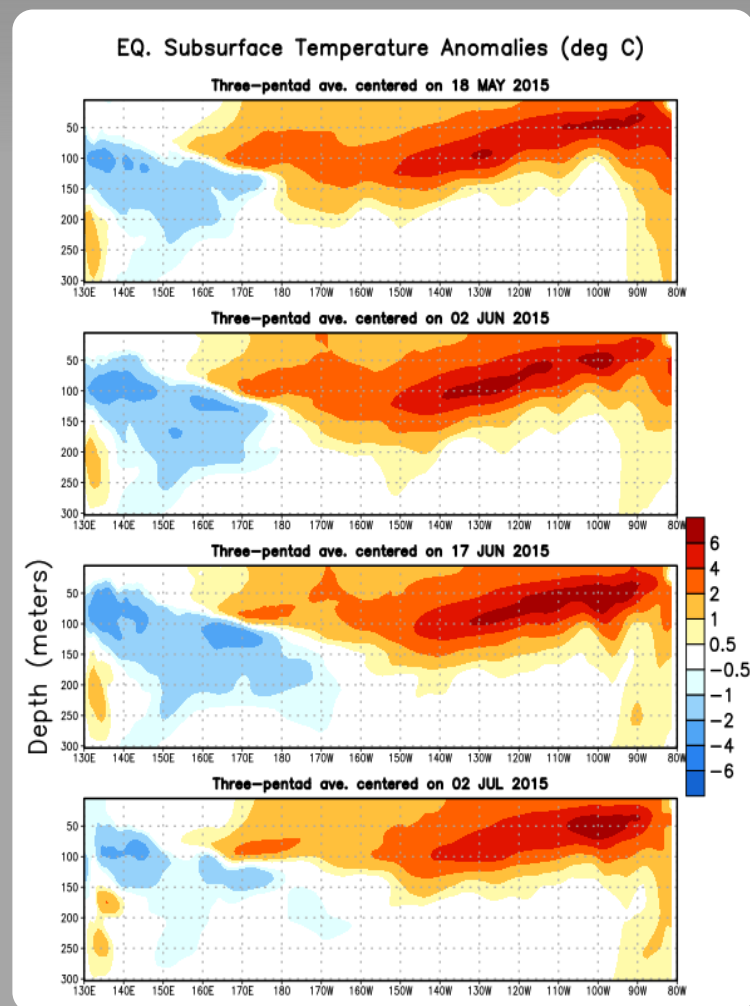
FIG. 2. Annually averaged Atlantic basin H, HD, MH, and MHD for the top 20 AMO years (blue bar) and the bottom 20 AMO years (red bar).

# Sub-Surface Temperature Departures in the Equatorial Pacific

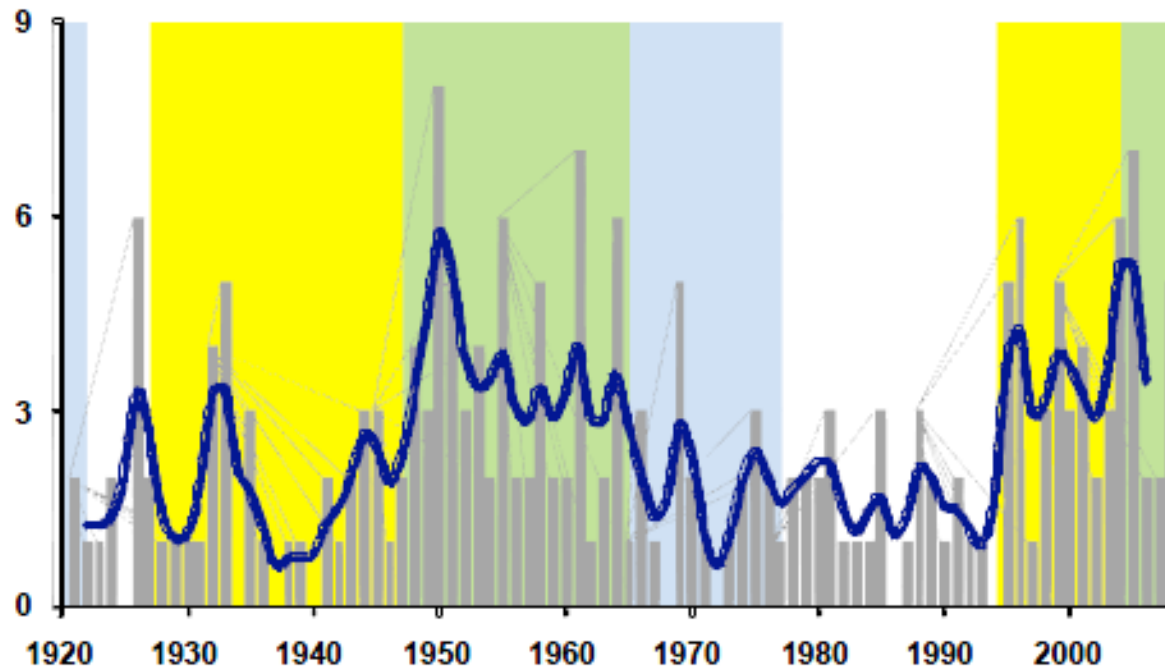
During the last two months, positive subsurface temperature anomalies were observed across most of the equatorial Pacific



Negative anomalies at depth have weakened in the western Pacific.



# NATL Major Hurricanes

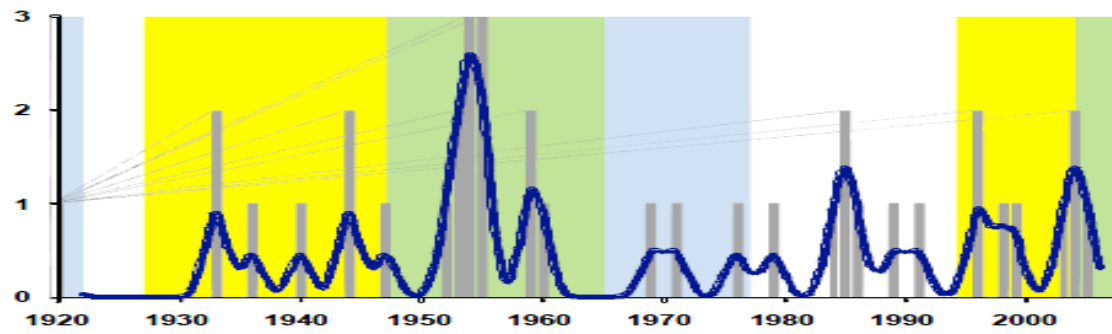


Strong increase in warm AMO, cool PDO

Figure Courtesy: M. Jelinek



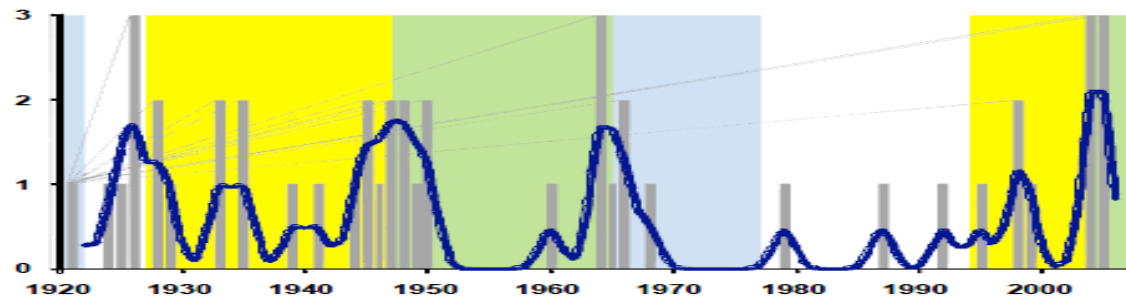
## ATL coast landfalling hurricanes



More landfalls in warm AMO, cool PDO

Figure Courtesy: M. Jelinek

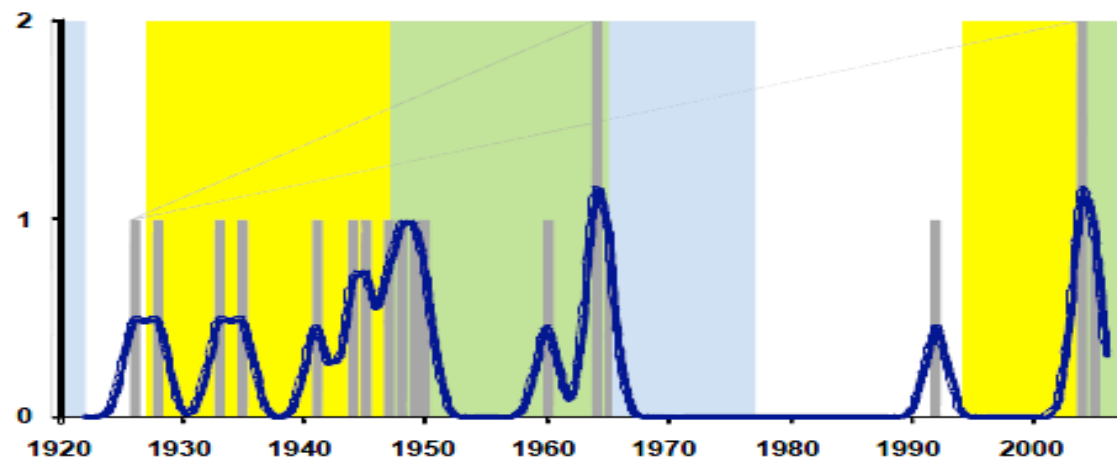
## FL Landfalling Hurricanes



More landfalls in warm AMO

Figure Courtesy: M. Jelinek

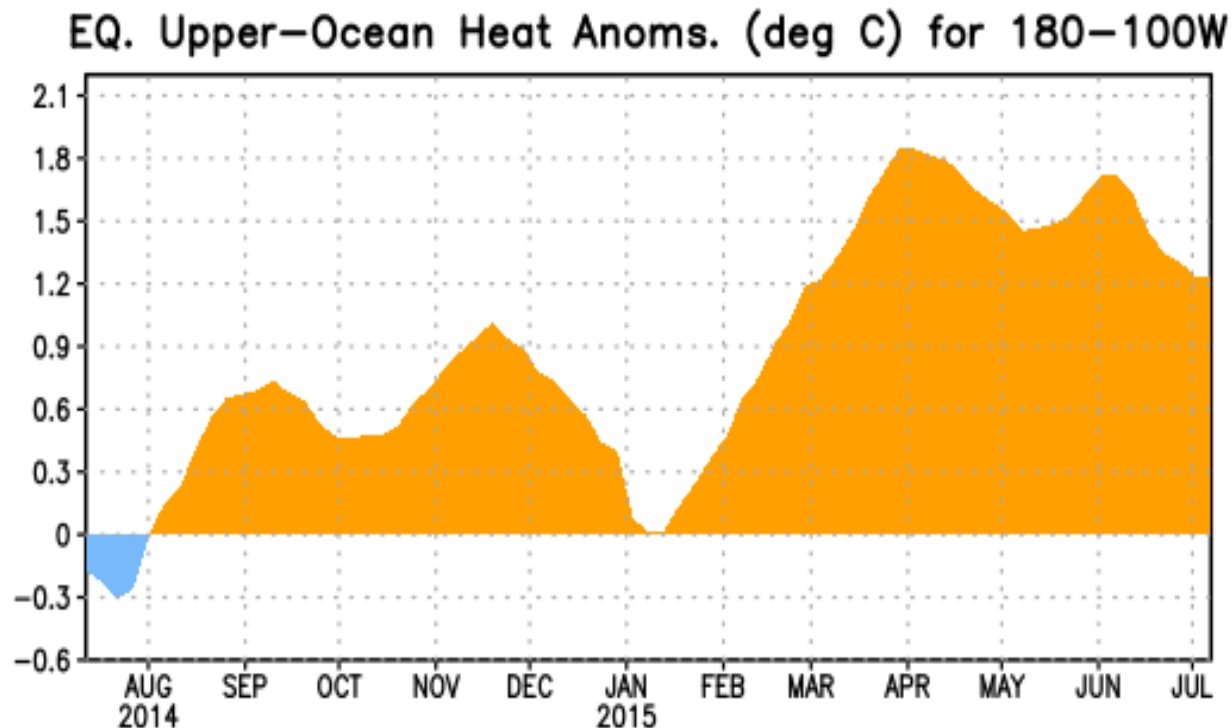
## FL Landfalling Major Hurricanes



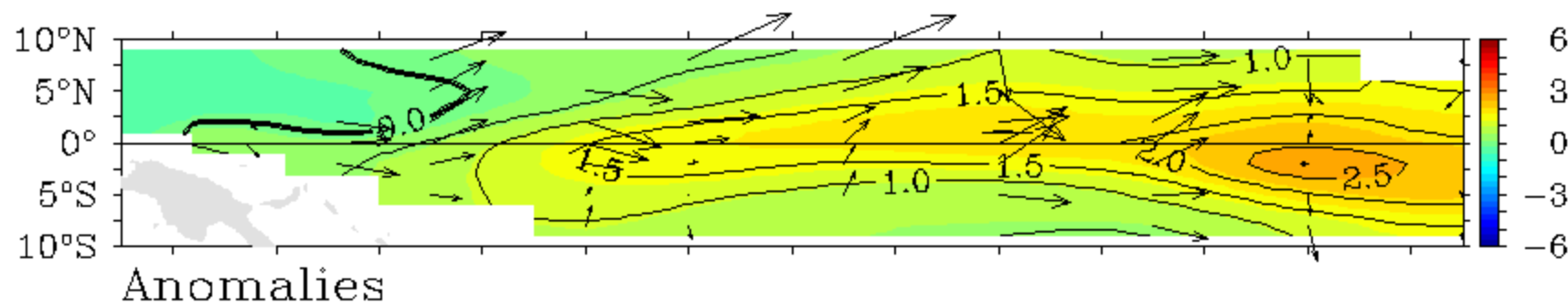
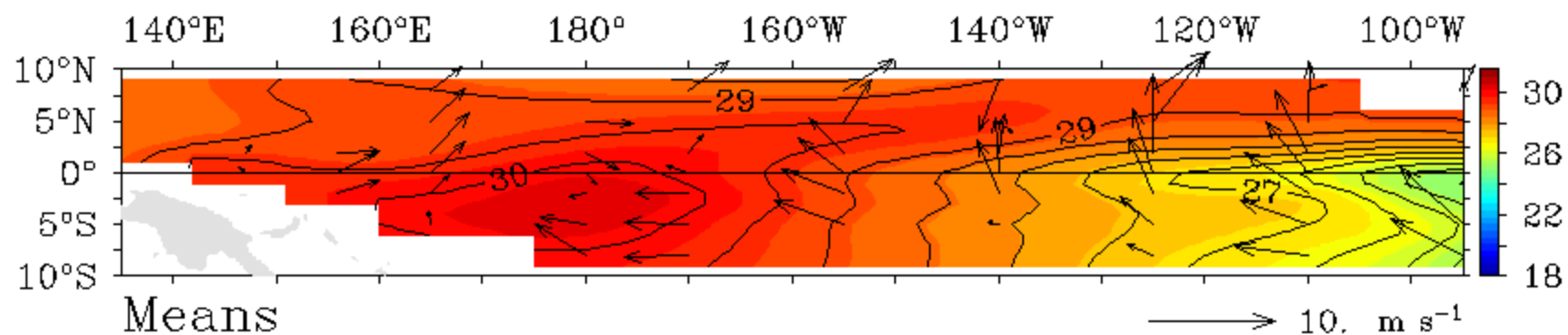
More major landfalls in warm AMO

# Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Subsurface temperature anomalies increased from mid-October to mid-November 2014 before decreasing to near zero in early January 2015. Temperature anomalies grew from January to March, decreased during April, and increased during May. During June, anomalies decreased.



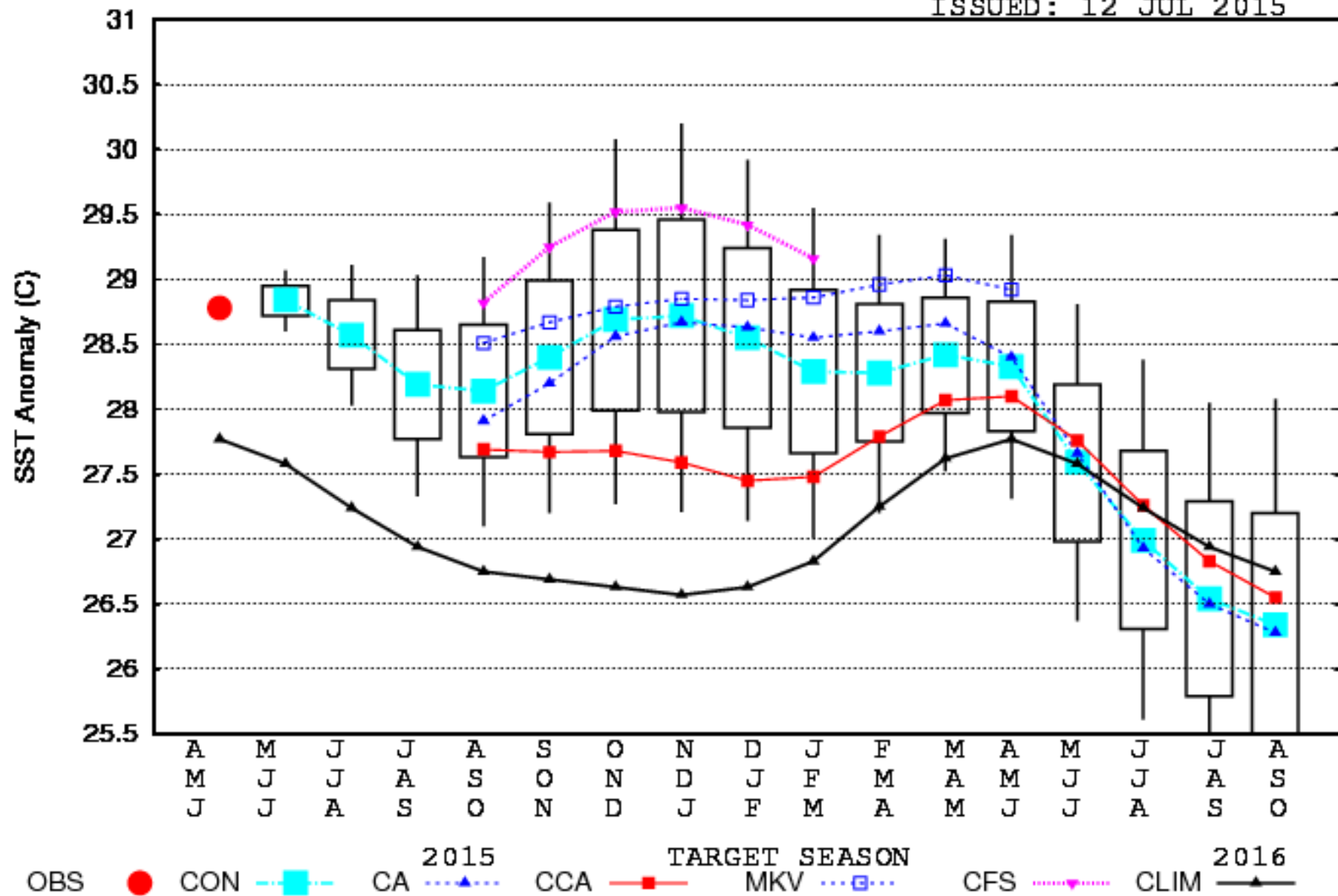
# TAO/TRITON SST ( $^{\circ}\text{C}$ ) and Winds ( $\text{m s}^{-1}$ )



Five-Day Mean Ending on July 13 2015

# SST CONSOLIDATION NINO 3.4

ISSUED: 12 JUL 2015





# Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v4

Recent Pacific warm (red) and cold (blue) periods based on a threshold of  $\pm 0.5$  °C for the Oceanic Nino Index (ONI) [3 month running mean of ERSST.v4 SST anomalies in the Nino 3.4 region (5N-5S, 120-170W)]. For historical purposes, periods of below and above normal SSTs are colored in blue and red when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

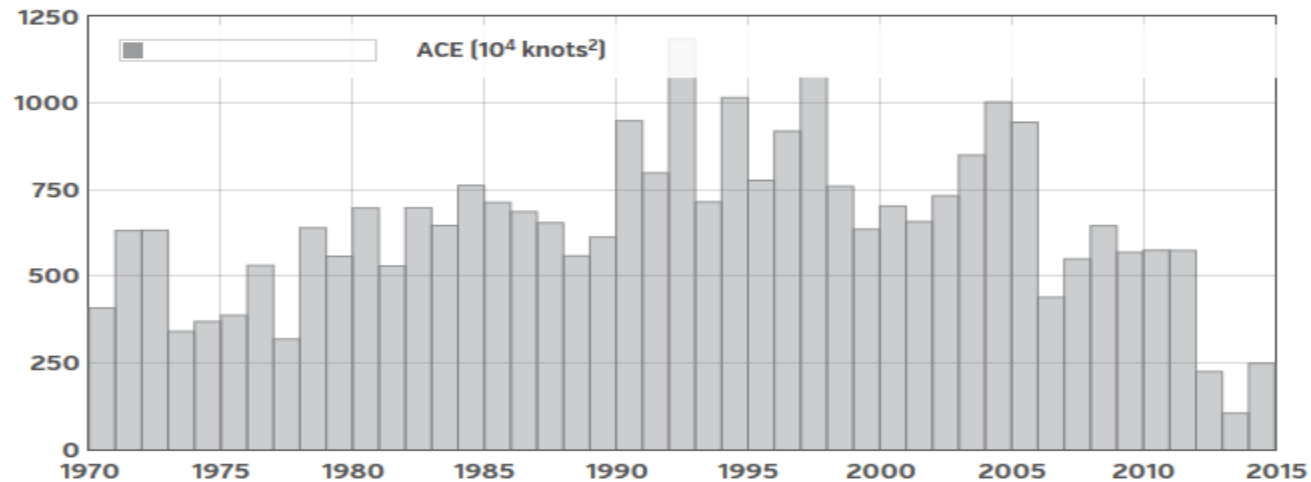
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2003	0.9	0.6	0.4	0.0	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	0.4
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.1	0.2	0.3	0.5	0.8	0.9	1.0
2007	0.7	0.3	0.0	-0.1	-0.2	-0.2	-0.3	-0.6	-0.8	-1.1	-1.2	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.3	-0.2	-0.2	-0.3	-0.5	-0.7
2009	-0.8	-0.7	-0.4	-0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.3
2010	1.3	1.1	0.8	0.5	0.0	-0.4	-0.8	-1.1	-1.3	-1.4	-1.3	-1.4
2011	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.3	-0.5	-0.7	-0.9	-0.9	-0.8
2012	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.2
2013	-0.4	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
2014	-0.5	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6
2015	0.5	0.4	0.5	0.7	0.9							

## Accumulated Cyclone Energy (ACE)

Atlantic	East Pacific	West Pacific	Indian Ocean	Southern Hemisphere	Global
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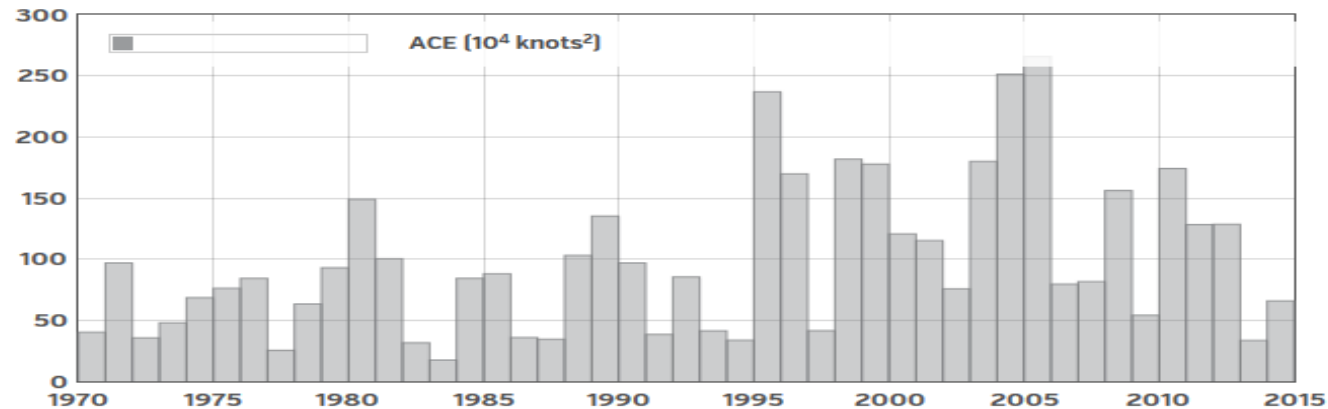
Updated: February 13, 2015



## Accumulated Cyclone Energy (ACE)

Atlantic	East Pacific	West Pacific	Indian Ocean	Southern Hemisphere
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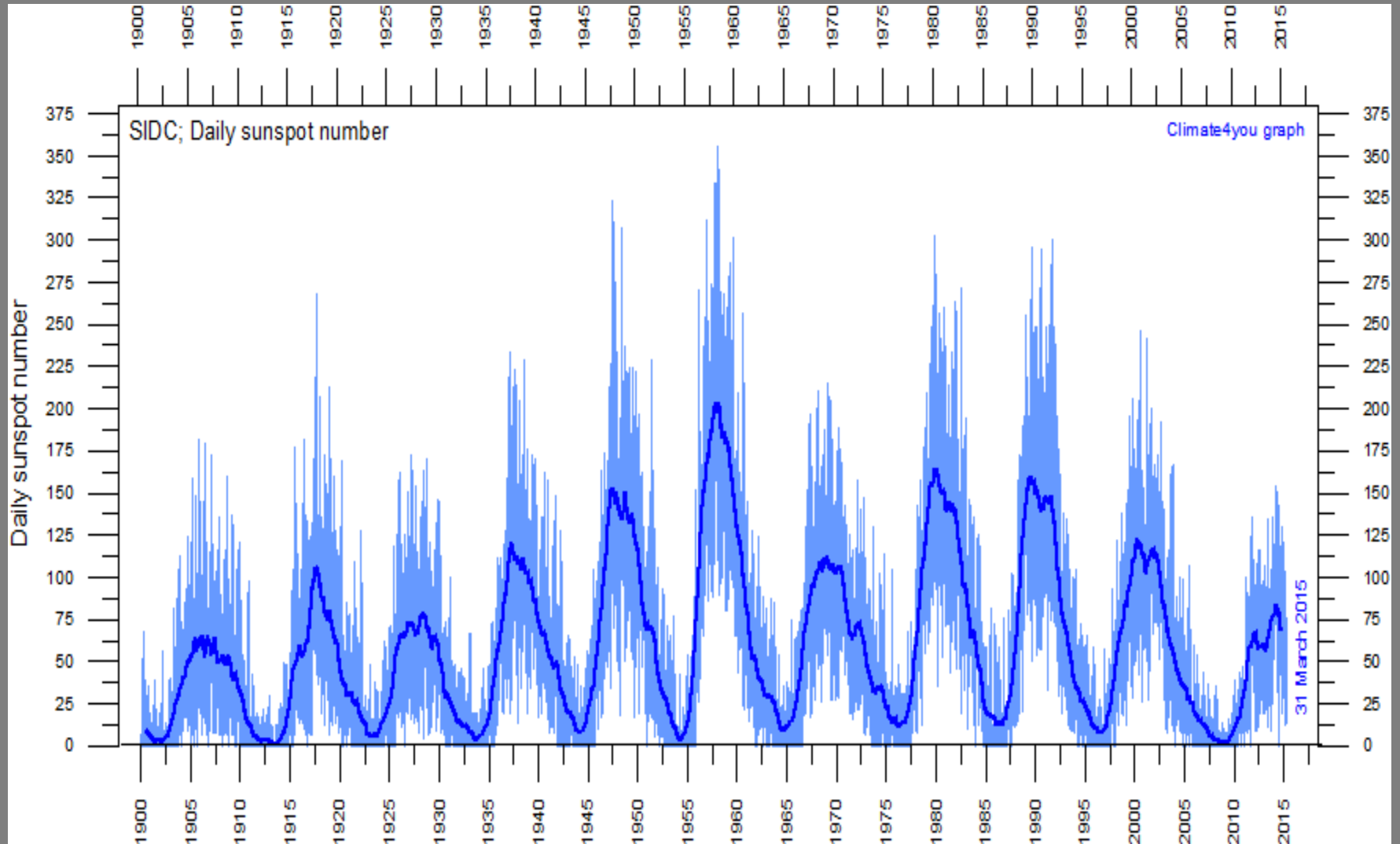
Updated: February 13, 2015



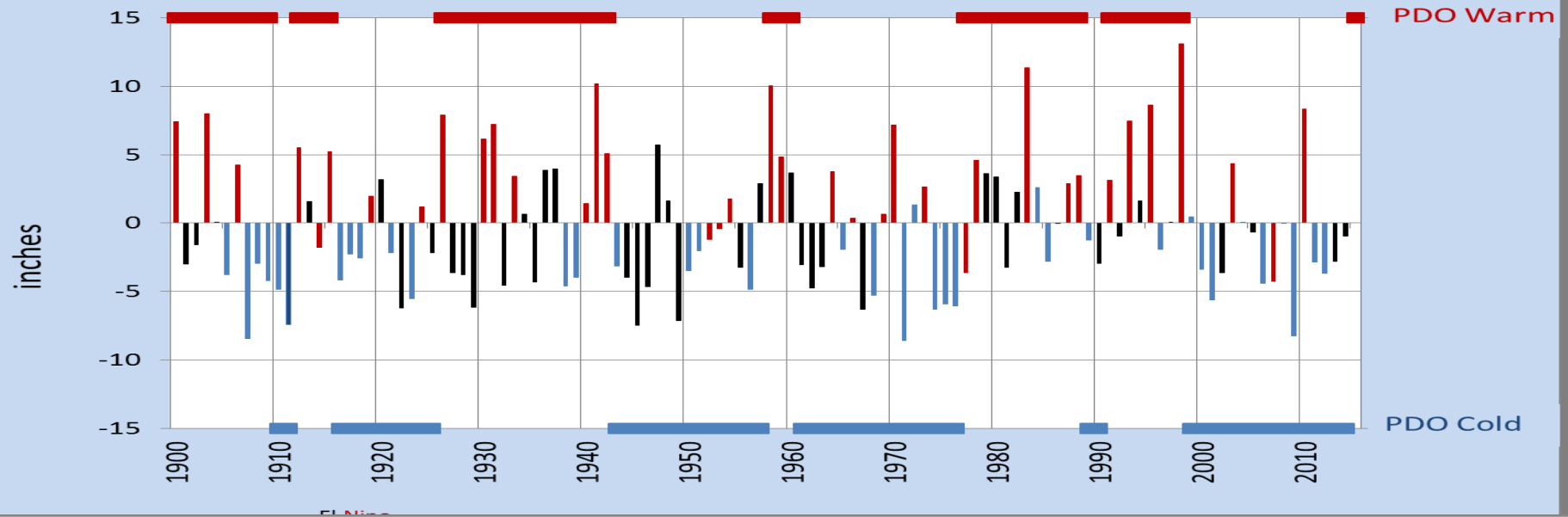
Average year: 110

2015 year-to-date: 0

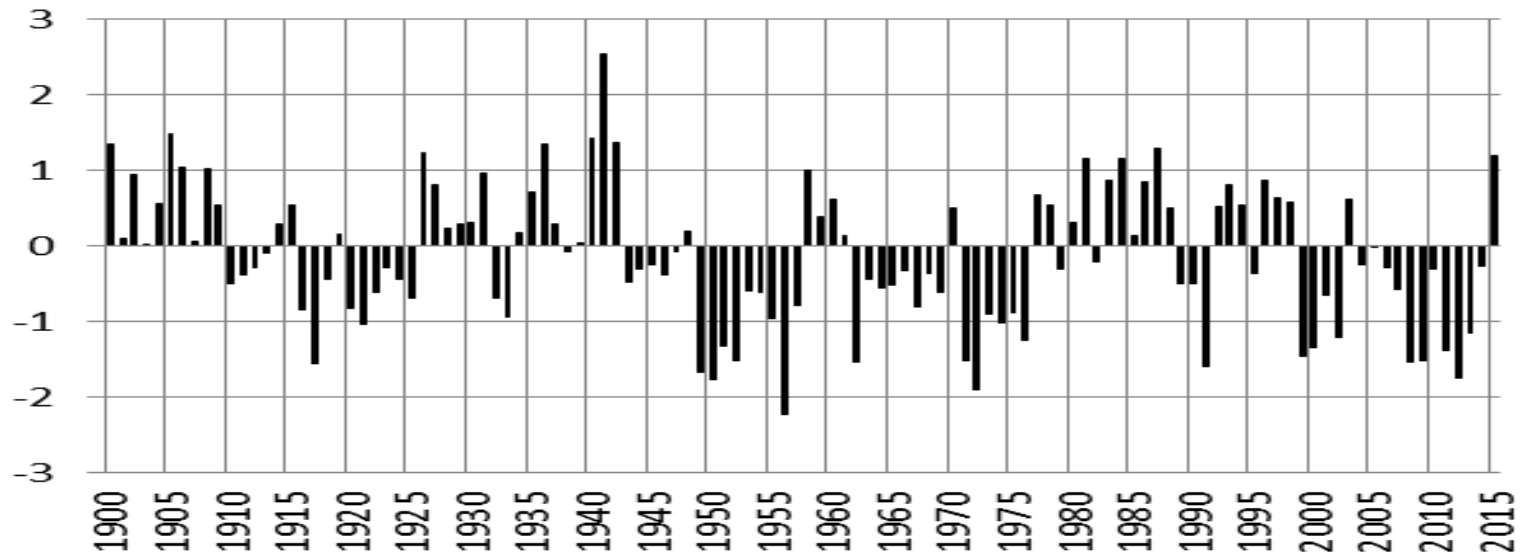
# Sunspot Number



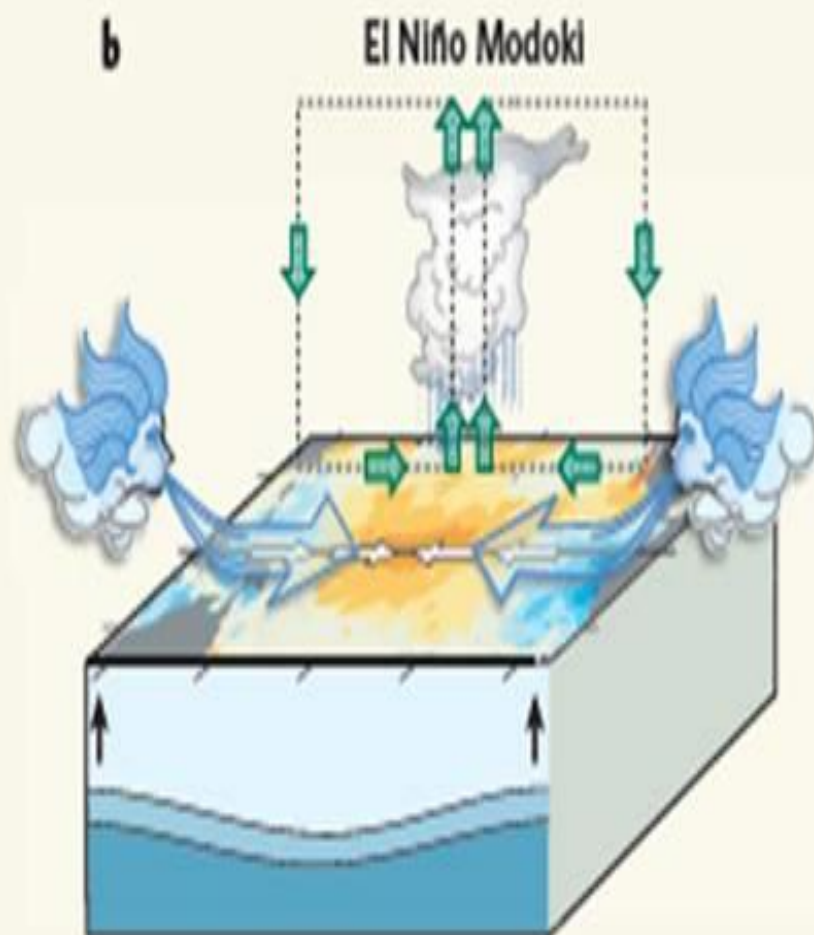
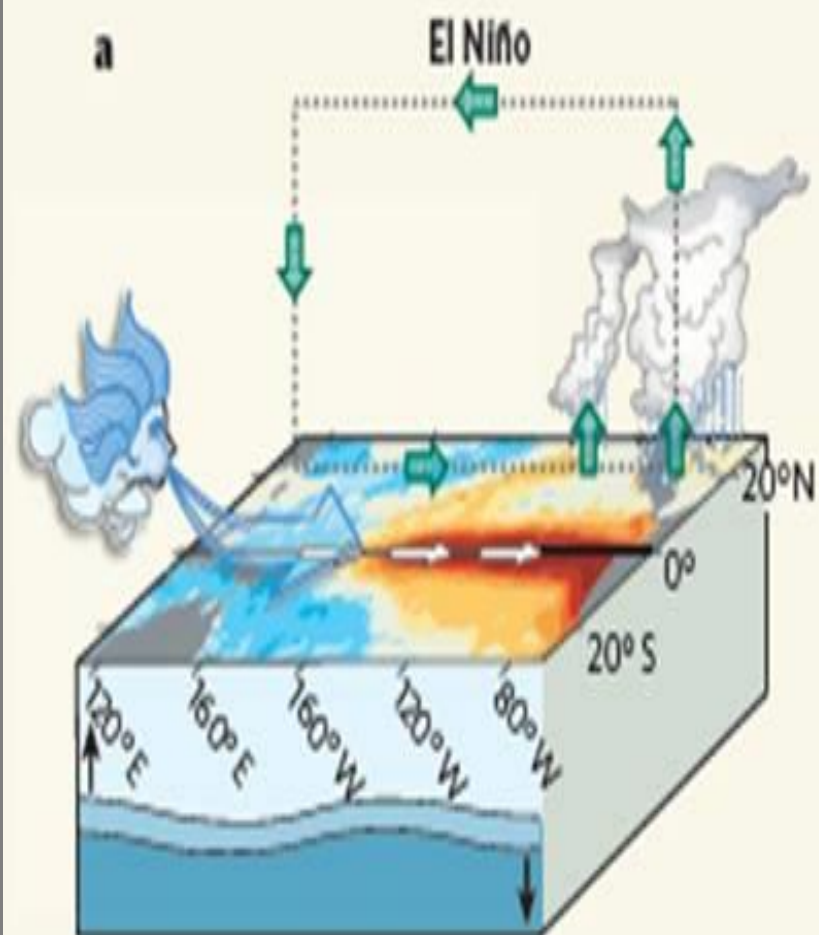
## District Rainfall Anomaly November thru April



## Pacific Decadal Oscillation







EOF2 (HadISSTA from 1979–2004; 12%)

